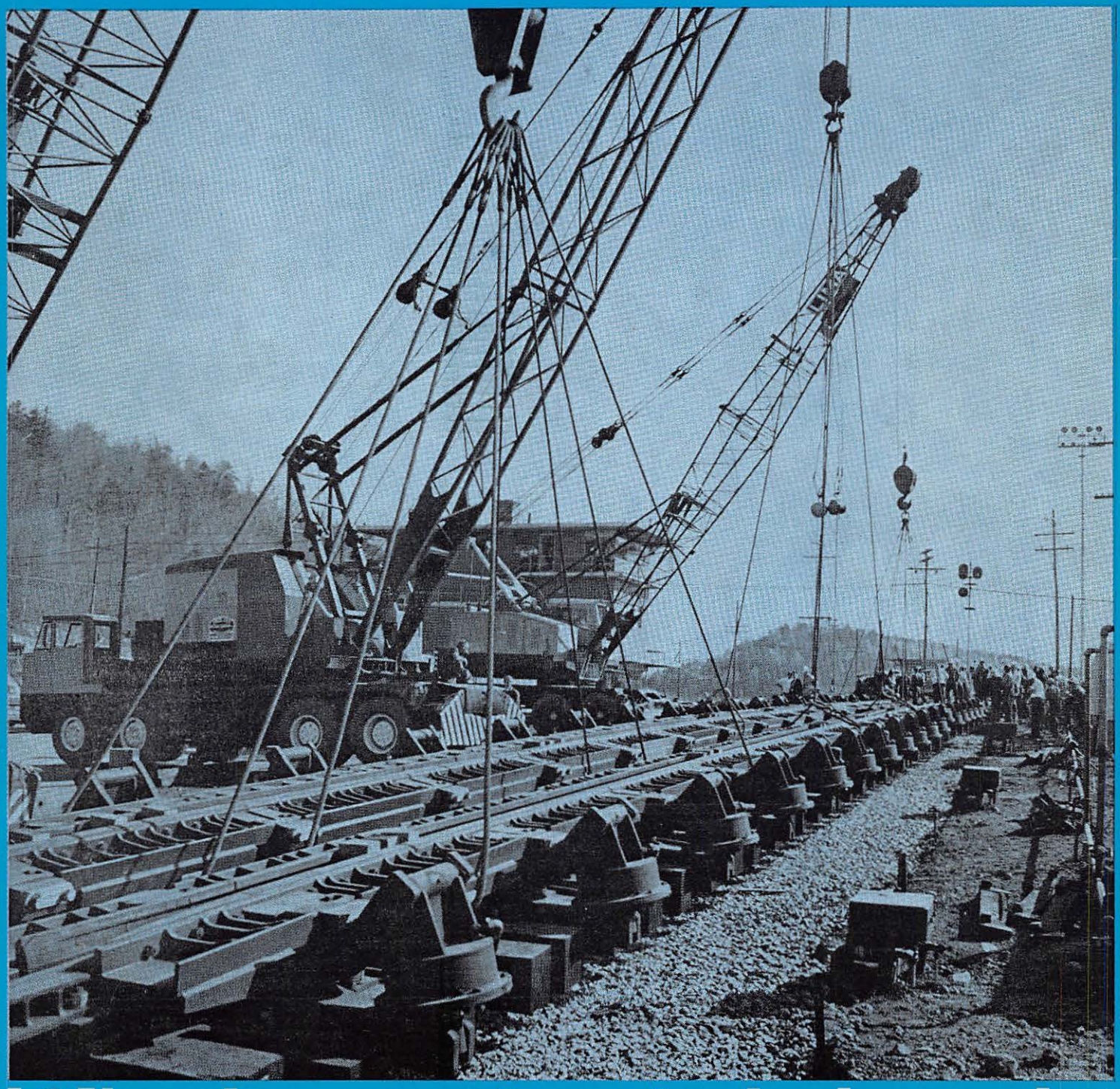
AUGUST 1970

rsc

RAILWAY SYSTEM CONTROLS



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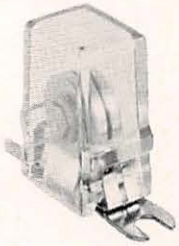 equalizers and power line protectors!

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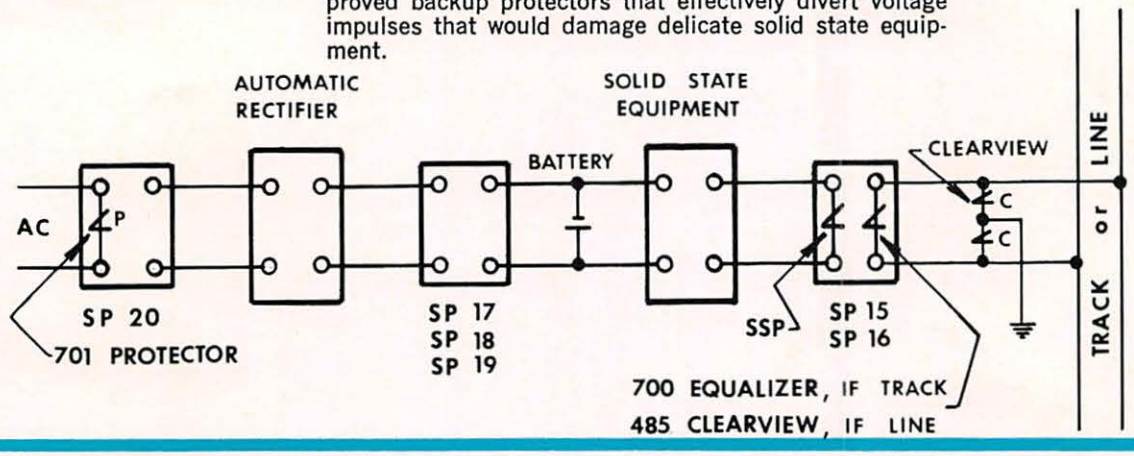

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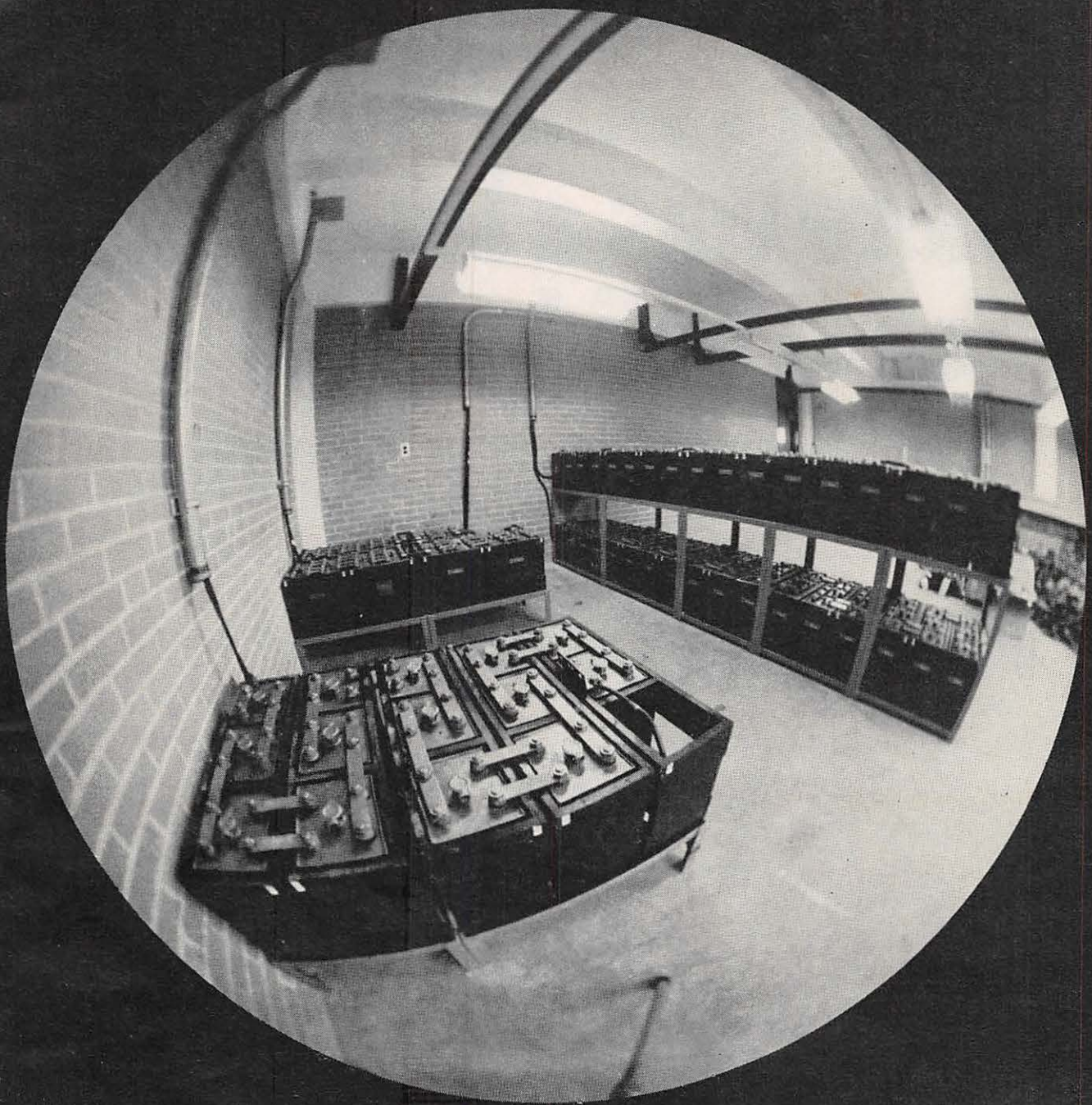
Circle 1 on reader service card



NIFE AT CONEY ISLAND

New York City Transit Authority's Coney Island Yard, the system's largest, is completing a major modernization. For the new Signal Control Tower, three NIFE nickel cadmium storage batteries were installed, along with four NIFE solid-state chargers.

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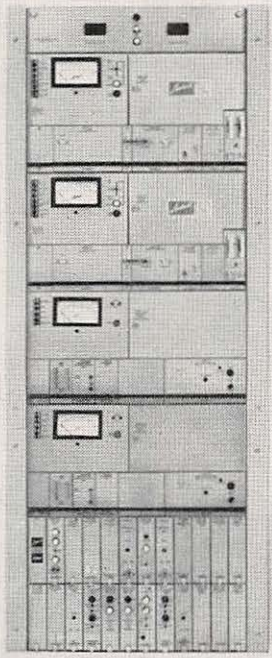

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Microwave Systems from Lenkurt

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RSC RAILWAY SYSTEM CONTROLS

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Editorial Office
29 E. Madison St., Chicago, Ill. 60602

Robert W. McKnight, Editor

Mrs. Grace Rempert, Editorial Assistant

Executive Office
30 Church St., New York, N.Y. 10007

Robert G. Lewis, Publisher

Fred B. Hecht, Production Manager

Maurice H. Mates, Art Director

John E. Rogers, Director of Circulation

Constance Nicolai,
Manager of Contracts

ADVERTISING SALES:

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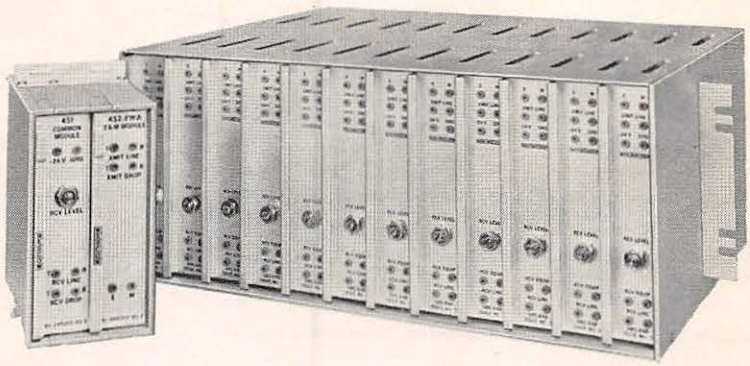

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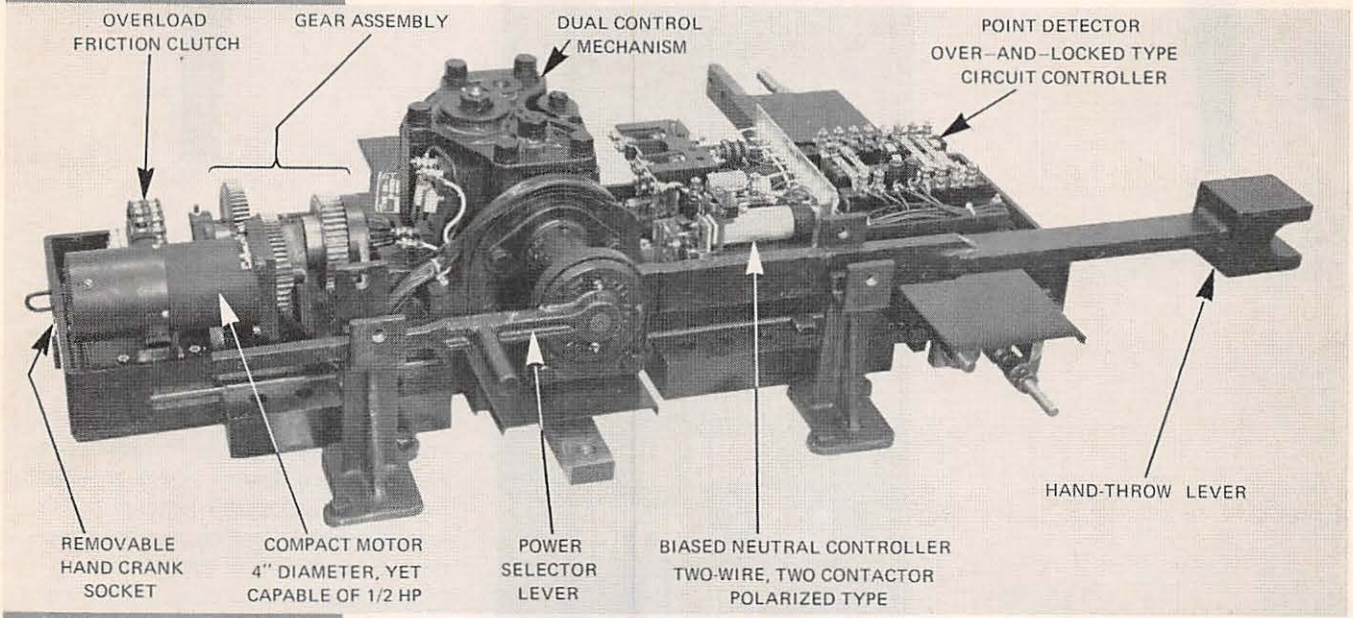
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55F	Yes	No	24 d-c or 110 d-c
55G	No	Yes 10/24 v. d-c	24 d-c or 110 d-c or 110 a-c
55H	Yes	Yes 10/24 v. d-c	24 d-c or 110 d-c or 110 a-c

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Circle 7 on reader service card

A simplified look at how T-carrier works and what it does for railroad communications

HOW IT WORKS

STROMBERG-CARLSON T-Carrier System employs pulse code modulated (PCM) carrier techniques to carry 24 high-quality voice channels over two telephone cable pairs.

Pulse code modulation means, in the simplest terms, giving a series of pulses the job of carrying the description of a minute portion or sample of a telephone signal from one point to another. Then, by sending descriptions of enough portions or samples of the signal, the signal can be reproduced at the distant end. A carrier system using pulse code modulation converts these telephone signals into series of pulses for transmission over wire, then reconstructs the signals at the distant end to provide a more efficient communications channel. How this is done is quite easy to understand and is well within the state-of-the-art in this age of microsecond electronic operations.

First, information theory tells the communications engineer how many samples of a signal must be described to the receiving carrier terminal by the transmitting terminal in order for the signal to be reproduced faithfully. In telephone conversations, if we take a sample each 125 millionths of a second, we get a faithful reproduction. So each 125 microseconds the sending terminal measures the size, or amplitude, of the signal at that instant. This amplitude measurement is the description of the sample of the signal.

The second step in the operation of a pulse code modulation carrier system involves a fact that may seem impossible, but it is proven by performance to be true. This fact is that one of 127 amplitude descriptions will adequately describe any sample of a telephone signal. If each of these 127 descriptions could then be transmitted from one carrier terminal to another, any signal could be reproduced at the distant end.

To get these 127 amplitude descriptions into a form which can be transmitted, a code has been devised which provides us with 127 identifiable series of pulses something like those created by operation of an ordinary telephone dial.

So, the sending terminal assigns one of the 127 codes of pulses which best describes the portion or sample of the signal obtained in the first phase of operation.

The next step in PCM carrier operation is the conversion of the assigned code from direct-current pulses to a more convenient and efficient alternating-current signal to carry it over regular telephone facilities. This step is only incidental to the pulse code modulation method, because in the next step, at the receiving terminal, the alternating-current signal is simply converted back to direct-current series of pulses which describes the sample of signal originally taken.

The last step, then, is the recognition by the receiving terminal of the code assigned to the sample of the signal and the emission of its identical twin, which it obtains from its vocabulary of 127 signals. The signal is thus electrically reproduced and ready for an acoustical device such as a telephone receiver.

But, of course, not enough would be gained if only one conversation were sampled for transmission in this manner. In the first phase of operation, we are told that a conversation must be sampled every 125 microseconds—so between the times the system samples this first conversation it has time to sample others. In the STROMBERG-CARLSON T system, it has time to sample 23 other conversations and send

the information on. Since the terminals are locked in synchronism, the channels are always kept in their proper order.

BENEFITS OF PCM CARRIER

There are several 24-channel cable carrier systems using Frequency Division Modulation. What does PCM offer over FDM?

Protection of Signal from Noise and Distortion

Noise and distortion have greatly reduced effect on PCM. Since these disturbances can enter the FDM system along the line, they are amplified at repeaters and result in some form of disturbance in the user's ear. In PCM, it's simple: once the sound portion is coded, only rare disturbances can upset this coding. The PCM codes will, therefore, go through unaltered and be reproduced. The principal sources of signal distortion in FDM systems are the repeaters along the line, particularly during heavy traffic. In PCM, only the pulse is being repeated; there is nothing to distort.

Highest Immunity to Crosstalk Brings Higher Percentage of Cable Fill

Limitations on cable fill are a product of crosstalk. The crosstalk problem, which is common to FDM systems, is reduced by PCM techniques. PCM recognizes only signals above a certain strength. Repeating and decoding are done before pulses fall below the recognition level. Crosstalk is simply blocked out. The result is more efficient utilization of pairs in each cable.

Unmatched Data Transmission

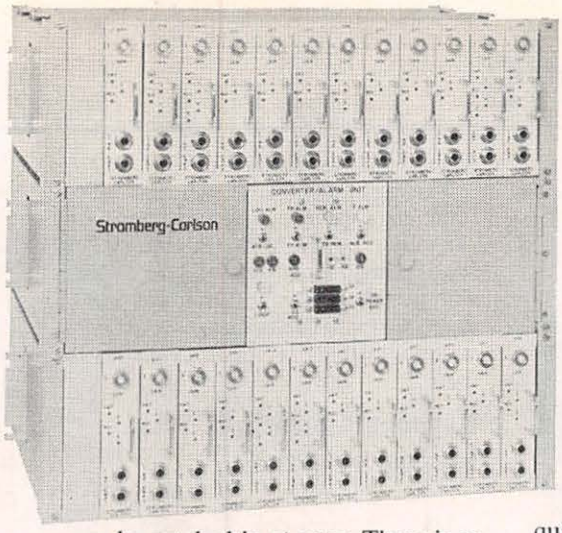
All 24 channels can be fully loaded with data in both directions without sacrificing quality. In a system with 23 channels loaded with data, the 24th channel can carry voice with no degradation of quality.

BENEFITS OF STROMBERG-CARLSON DESIGN TO RAILROAD COMMUNICATIONS

The STROMBERG-CARLSON T design uses the very latest proven electrical and mechanical design techniques and gives the user these advantages:

Built-in Troubleshooter

Our system automatically monitors for the spurious signals. Determination of whether the trouble is in the incoming or outgoing line signal is immediate. Since there is no need for special test equipment to make this determination, there is no interruption of service. When a problem occurs, a spare span



can be patched in at once. There is no question about its being operational, since our detection system monitors this circuit. Automatic error detection which provides this very valuable feature is standard in the STROMBERG-CARLSON T-1 system.

Rapid Expansion without Service Interruption

Terminals need not be fully equipped with channel units. Plug-in channel units can be added, removed, or changed at any time without interrupting service on other channels. Each repeater case holds up to 24 two-way repeaters (for 576 two-way channels). Adding repeaters is simple, quick, and inexpensive.

Repeater Interrogated from Central Office

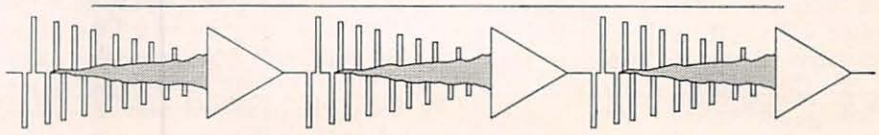
Repeaters for the system are powered over the physical. The operating condition of the repeaters can be verified from either terminal by built-in interrogation equipment.

Saves Expensive Floor Space

Each basic 24-channel terminal requires only 15¾ inches of vertical space on a standard 19-inch equipment rack. Eight complete terminals (192 channels) can be mounted on one standard 11′6″ rack; six terminals mount on a 9′ rack.

Lower Installation Cost

Each basic 24-channel terminal assembly is completely wired and tested before it is shipped. Only an external drop, power, and line connections are required.



Symbol represents voice signals with noise and crosstalk as rough overlay.

The symbol represents voice signals being transmitted on Stromberg-Carlson T-1 Carrier as a bipolar, binary train of pulses, with noise and crosstalk as a rough edge overlay. The pulses are attenuated as they travel the cable pair to the first repeater while noise and crosstalk are increasing. The repeater recognizes and regenerates the pulses, virtually eliminating noise and crosstalk, and the process is repeated.

TRANSMISSION PRODUCTS FOR OPEN-WIRE USE

S-C 761 Party Line Carrier: a transistorized medium-haul three- or four-channel system that can reduce load on message circuits by as much as 75%. The system upgrades way stations operating with 35-40 parties per line to only 10 or fewer parties per line. For additional efficiency and economy, the 761 is convertible to our 765 Trunk Carrier System.

S-C 661 Party Line Carrier: a 12-channel stackable double-sideband system that provides one to 12 full-duplex voice channels on a single VF telephone circuit. Each channel can serve up to 10 parties, with selective ringing of each. Choice of plug-in cards provides bridged, divided, or superimposed ringing.

For complete information on any of these communication systems, call Jim Codd at (716) 482-2200. Or write Railroad Division, Stromberg-Carlson, 100 Carlson Road, Rochester, N. Y. 14603.

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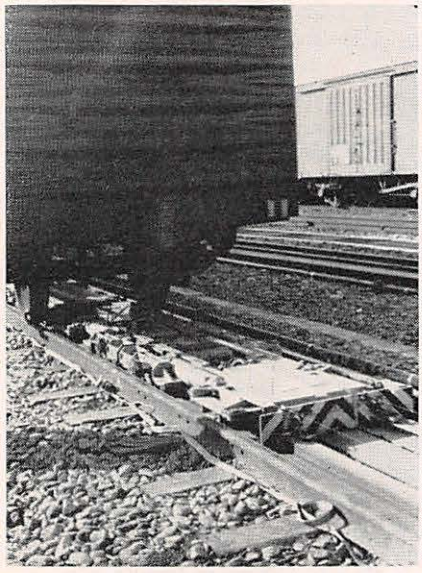
News Briefs



Yard braking system to be tested on JNR

A linear motor, automated system for braking cars during shunting operations will shortly undergo tests at one of Japan National Railways' larger yards. Components of the system include a pusher car, control car and linear motor car. The operational procedure is programmed so that a freight car being shunted from the hump is stopped by the "arms" controlled by the linear motor car waiting in the sidings. The freight car is then automatically pushed at a safe speed for coupling with the standing train. The system, built by Hitachi Ltd., also provides automatic control at a constant speed of freight cars regardless of the degree of friction, wind direction, wind velocity, weather conditions and grade.

WU forms new company for data services

Western Union Corp. has organized a new company, the Data Services Co., to become a major supplier of data terminal equipment and dedicated data communications systems and services. Z. V. Zakarian, vice president WU, who will head the new operation, said that data services "will operate on a nationwide basis, with a separate management team and with nationwide field sales and service responsibility." Three basic functions include: "(1) dedicated data systems design and support; (2) a broad range of data terminal equipment; and (3) nationwide maintenance and service support for systems and devices."

The new company will not offer common carrier communications services but, rather, will design, sell, or lease components and systems that will permit customers to make maximum use of the message and data communications facilities available to them."

Opponents seek full hearing on Datran

Data Transmission Co., which has applied to the Federal Communications Commission for a special service microwave common carrier system, is now opposed in its request for special interim operating authority and preferential expedited hearings. Bell System Companies, Western Union, and Southern Pacific Communications Co. claim that the question of public need has yet to be resolved.

According to *Telecommunications Reports,* Southern Pacific took issue with Datran's references to serving "the" data markets, and said that while there may be variations among the applicants "in techniques, there will be an overlap of a substantial portion of the means-microwave relay; of the methods-digital as well as analog; of the customers—communications users; and of the subject matter—data communications.

"The Commission must make an informed judgement, based on evidentiary facts, of the nature of the data communicatons market, its size, and its needs, before it can determine how much competition the market can support, how many applicants can survive, and what is the most effective means of meeting the public interest, convenience, and necessity among the existing and proposed facilities."

Stating that it supports expedited consideration of all the applications, Southern Pacific suggested that "perhaps a determination can first be made of the nature and extent of the market available for the proposed specialized common carrier services, as a predicate to a decision whether and to what extent the various applications may be economically mutually exclusive, and which applications should be granted."

It added, "Although Datran claims that its proposed network is a switched system, and thus is not comparable with other systems proposing dedicated point-to-point service, there is no disclaimer that it will not in fact also offer dedicated channels. To the contrary, it may be noted that in its application, Datran has stated that high-speed data transmission above 14,400 bits per second—would only be available on a private line basis. Thus Datran would offer high-speed service competitive with Southern Pacific's proposed operation, and its proposed operation would not be unique and exclusive."

Bell asks remand of MCI case to FCC

Bell System Companies have asked the U.S. Circuit Court of Appeals for the District of Columbia to remand the proceeding concerning Microwave Communications Inc., St. Louis-Chicago microwave application to the Federal Communications Commission. The request is made because MCI has now filed an application with the FCC to make substantial modifications to its original system.

TACV system set for Los Angeles

Secretary of Transportation John A. Volpe announced a $300,000 grant aimed at providing the Nation's first passenger-carrying tracked air cushion vehicle transportation system which will serve the Los Angeles International Airport by late 1972. The tracked air cushion vehicles will run on elevated concrete guideways at speeds up to 150 mph from the airport up the San Diego Freeway to the San Fernando Valley. The vehicle will be powered by electric linear induction motors (LIM) which are pollution free and virtually noiseless.

Volpe announced a grant of $50,000 to the Los Angeles Department of Airports to finance an initial feasibility study of the access line which is now nearing completion. He said he had approved an amendment to the same grant for an additional $250,000 for preliminary engineering and marketing studies.

The total cost of the 16.3 mile line including guideways, stations and other supporting facilities is expected to be in excess of $50 million. This cost will be divided essentially on a 50-50 basis by the Department of Transportation and the Los Angeles Department of Airports. The tracked air cushion vehicle (TACV) runs on a thin cushion of air that supports and guides it and which is supplied by the vehicle itself.

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Signalmen take strike vote in wage case

With ballots to be returned by August 1, the Brotherhood of Railroad Signalmen's officers are seeking support in a wage case with the nation's railroads. Wage requests for increases and allowances were served by BofRS on the railroads on Oct. 1, 1969. Counter-proposals were served by the railroads on Oct. 7 and Nov. 3, 1969. The case is now before the National Mediation Board. Ballots seek union members authority for or against a strike in support of their wage demands.

Crossing accidents fall in 3rd year

Rail-highway grade crossing accidents dropped again in 1969. The number of accidents last year totaled 3,774 with 1,490 people killed and 3,699 people injured. In accidents involving motor vehicles and trains, 71 people were killed and 121 injured at crossings equipped with gates. At crossings with audible and visual signals (flashing-lights and bells), 263 people were killed and 784 persons injured. Where only flashing-light signals were in service, 186 people were killed and 452 people injured in rail-highway grade crossing accidents in 1969.

SCL to install ACI scanners

Seaboard Coast Line plans to install three automatic car identification scanners to cover receiving and departing leads at Hamlet, N.C. yard. Another ACI scanner will be installed at the new phosphate terminal in Tampa, Fla.

Train control system out for bids by WMTA

Requests for bids have gone out to electronic and control systems suppliers for an automated system for Washington, D.C.'s new subway. Essentially control will be automatic for train operation, protection and overall system controls. Also, included will be monitoring of key facilities and voice communications between moving trains and dispatching headquarters.

Lynch and Plantronics stop merger talks

When Lynch Communication Systems reduced its share-for-share basis of acquiring Pacific Plantronics, PP rejected the offer. Negotiations for merger of the two have ceased.

FCC approves sale of TWX to Western Union

In a 5 to 1 vote Federal Communications Commissioners agreed to approve the sale of American Telephone & Telegraph's teletypewriter exchange service (TWX) to Western Union. The telegraph company will pay $85 million for TWX.

SP supports FCC data decision

Support for the Federal Communications Commission's tentative decision not to regulate data processing firms came from many companies, including Southern Pacific Communications Co. SP said FCC's decision is "promoting a reasonable and appropriate balance between the public interest in efficient and effective communications services to serve the emerging communications requirements for the processing of data, and the public interest in the continued flourishing development of competitive and diversified computer services."

S&C $8 million order placed by Yugoslavia

Compagnia Italiana Westinghouse Freni e Segnali, a WABCO subsidiary, will supply electronic and electro-mechanical equipment, engineering design, and technical installation assistance for approximately 155 miles of main line track linking Belgrade with Hungary and with Bulgaria. The equipment will include 450 automatically controlled entry, exit and shunting signals.

Supplementary equipment includes power switches, automatic grade crossing equipment, telecommunications, teleprinter and telephonic equipment. Also included in the contract is the purchase and installation of Flexicode train describer CTC systems on all main lines throughout the Serbian Republic.

CN orders ACI system from Sylvania

Canadian National has awarded a contract to Sylvania Electric Products Inc. for 11 KarTrak automatic car identification systems. Delivery is scheduled for this fall. Installation will be at Montreal, Toronto, London, Fort Erie, Niagara Falls and Sarnia. Also, ACI will be installed at Symington yard in Winnipeg. ACI equipment has been on test on CN's mainline west of Toronto and on a mainline north of that city.

BN orders radio units from S&C div. Wabco

Burlington Northern has ordered 30 radio sets from the Signal & Communications division, Westinghouse Air Brake Co., for installation on locomotives. Also purchased were 20 radio sets for use in mobile supervisory vehicles.

C&O/B&O to equip locomotives with radio

Seventy-five locomotives of the Chesapeake & Ohio/Baltimore & Ohio will be equipped with two-way radio sets furnished by the Signal & Communications division, Westinghouse Air Brake Co.

SCL to install radio on 30 locomotives

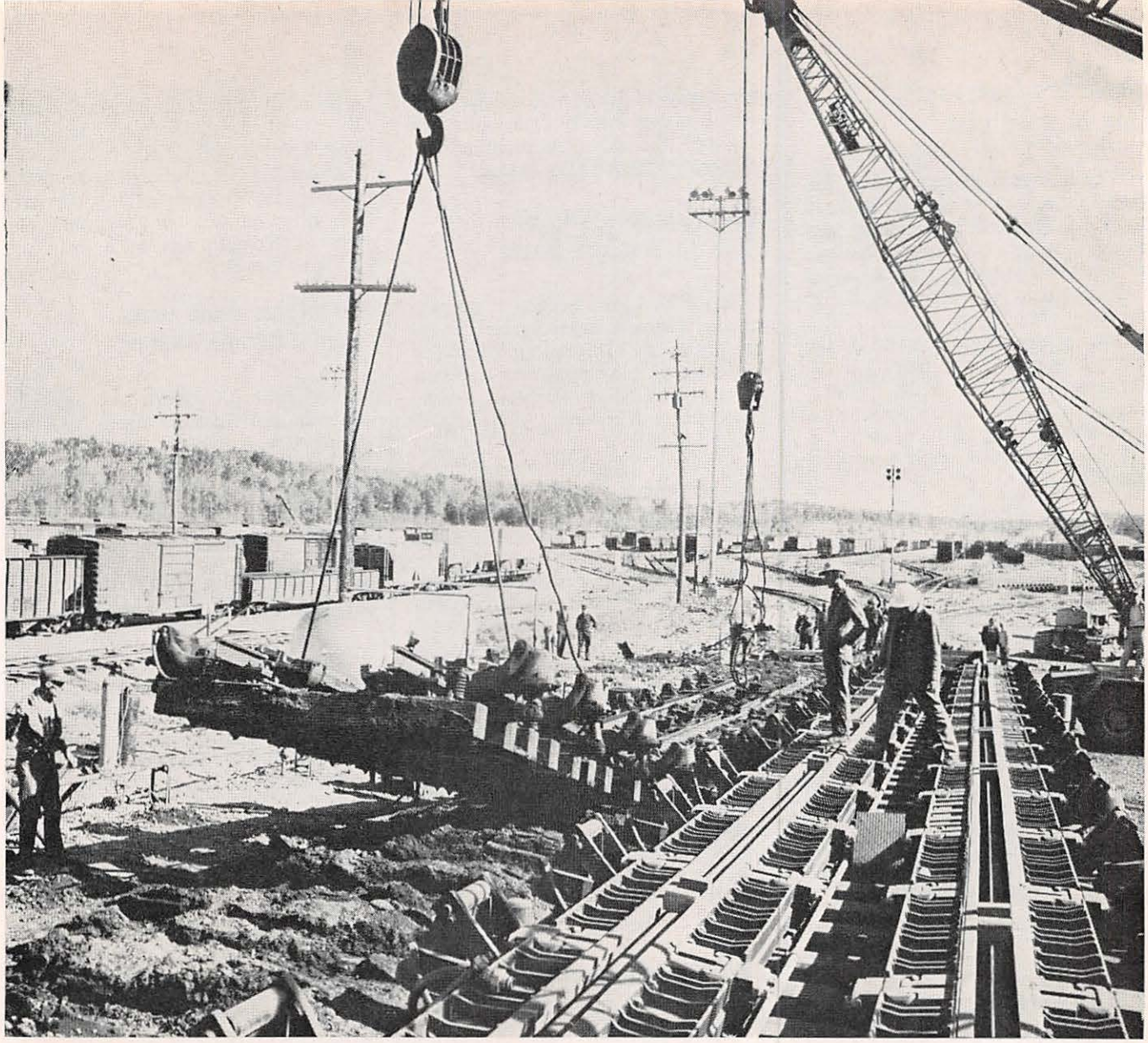
Seaboard Coast Line will install new two-way radio sets on 30 locomotives. Equipment is supplied by the Signal & Communications division of Westinghouse Air Brake Co.

Sangamo's Transitel moves to Denver

Transitel Computer Support Systems, a division of Sangamo Electric Co. will move to 5155 East 39th Ave., Denver, Colo. Herbert J. Henderson, general manager, said the move will bring together four major functions: engineering, marketing, field services and product engineering. Transitel designs, manufactures, sells and services keyboard-to-tape data preparation equipment, data communications terminals and other computer support equipment.

Lehigh Valley gets OK for TC system

Federal Railroad Administration hearing examiner Robert R. Boyd has approved the Lehigh Valley's application to install a traffic control system and remotely controlled interlockings between Laceyville and Athens, Pa., 44.6 miles. Control will be from Sayre, Pa.



Classification yard upgraded with

"What a difference a day makes" are more than just words in a popular song (many years ago). April 8, 1970 at Boyles yard on the Louisville & Nashville was certainly different than Tuesday, the 7th. At L&N's Birmingham, Ala., major classification yard, the hump area swarmed with 60 signal and maintenance-of-way men from dawn to dusk on the 7th. Their job—replace the master retarder.

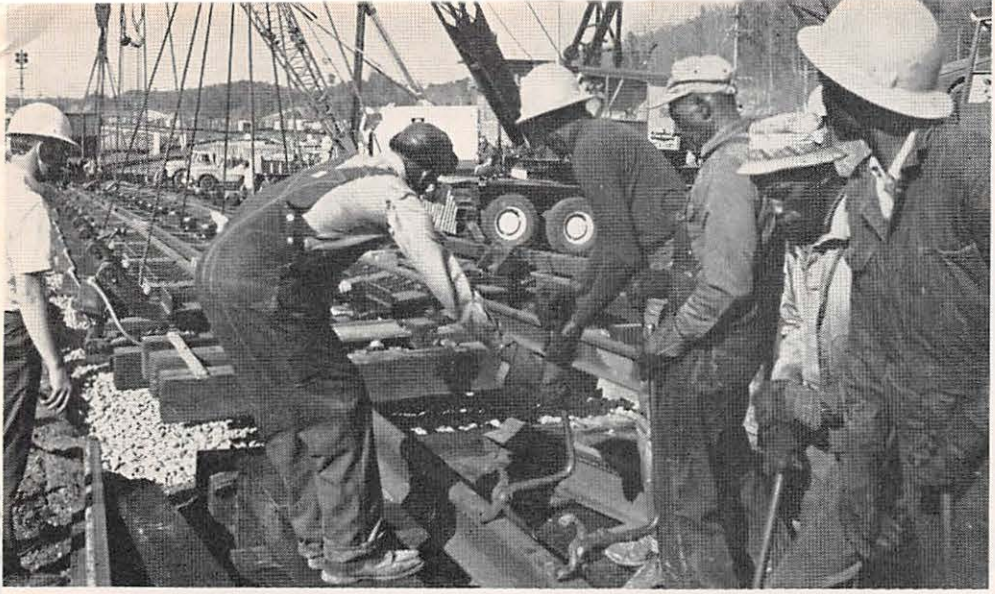
There is more than simply lifting out the old retarder and installing the new one. If fact, the replacement job was really started several months before when materials were ordered, schedules drawn up to detail the work to be done, and the new 3-unit master assembled alongside the old one prior to replacement day.

Some 12 years and 15 million cars ago, Boyles yard was opened for service. Since that time, cars have been getting heavier to handle greater payloads. So L&N was faced with the need for upgrading retarders to handle today's 160-ton cars.

By 7:30 a.m. on that Tuesday morning (a light traffic day) in April, the last cut had been humped and signal and m/w forces were ready to change out the master retarder. Air lines and signal control cables were disconnected from each of 36 cylinders of the old retarder. Welding torches were used to cut the 116-ft old master retarder into three sections. They were lifted out of place using three mobile cranes.

With the old retarder out of the way, bulldozers moved in to remove dirt and clean out the old bed. New ballast was spread to a depth of two feet to form a bed for the 160-ton new master retarder. This unit, previously assembled alongside the older unit, was lifted into place by the cranes. Control cables and airlines were hooked onto the new retarder. Also, a new and larger air tank was installed as were two new, larger-capacity air compressors and booster units. The new retarder, also in three sections, can apply pressure at 160 psi on car wheels.

During this change-out period, other forces renewed some track and upgraded other facilities. For example, rail was renewed on hump leads, and brake shoes replaced in group retarders. Track crews installed new steel pipe in the lower end of the retarder bed to improve drainage. Scale department personnel renewed structural steel members and other weighing equip-



NEW WABCO RETARDER is set in place with three cranes, and will be hooked up shortly.

CABLES AND AIRLINES are connected to new retarder cylinders by signal department personnel.

OLD RETARDER cut into three sections is removed by cranes. Then old ballast replaced with new.

RSC RAILWAY SYSTEM CONTROLS

MANAGEMENT INFORMATION

Although retarder replacement is vital to keep automatic classification yards operating at peak efficiency, there is much more signal and communications maintenance work that is performed on a continuing basis without being so obvious. Fortunately, most railroads have been able to afford the tools, equipment, and skilled maintenance personnel required to keep signal and communications systems operating.

As railroads have learned with sophisticated computer systems, so with advanced automatic yards and communications systems utilizing solid-state electronics and computer-oriented facilities, skilled maintenance personnel are necessary. Also, vital is a willingness on the part of management to support preventive maintenance, inspection and testing routines. Proper maintenance keeps troubleshooting to a minimum and keeps systems operating, notes one railroad's S&C engineer.

new master retarder

ment on track scales just below the crest of the hump.

By sundown, the major work was completed, and with a few minor adjustments, the new master retarder was again in operation. For the men, it was a long day; but by no means so remarkable for L&N's signal and track departments. They had performed such feats before. In 1964, the master retarder at Radnor yard, Nashville, Tenn. was replaced in about seven hours. And give or take 30 minutes, L&N men performed the same "transplant" on the master retarder at Tilford yard in Atlanta in December 1964.

W. H. Dorsey, supervisor communications and signals, directed the operations at Boyles, as he had done at the other L&N yards. He is in charge of retarder yard maintenance, under the general direction of J. P. Powell, superintendent signals.

Replacing master retarders, although important, is just one of many jobs that must be done to keep an automatic retarder classification yard operating at peak performance.

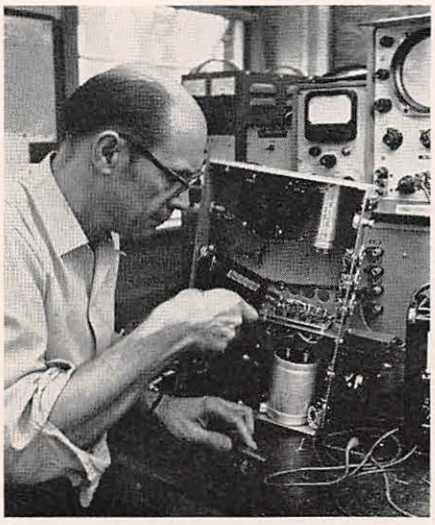
"You just can't spend several million dollars for a computer-operated automatic yard, and then forget it once it's in operation. The automatic yard has a computer, other electronic equipment including radar, extensive communications facilities, and electrical machinery (switches and possibly retarders) that need attention. You've got to keep this equipment in adjustment and repair. To get your return on the investment, the yard is kept busy, so downtime must be minimized. It just makes good economic sense to keep an automatic classification yard operating at peak efficiency," comments a large railroad's signal engineer.

Although as might be expected signal maintenance is a larger expense than communications maintenance, the latter is vital to keep these large yards operating at top performance. For the most part, the communications maintenance at an automatic yard requires only a portion of the regular terminal communications maintenance forces, such as electronic technicians, linemen, radio maintainers, equipment installers, etc. One railroad, for example, reports that the communications facilities at one of its automatic classification yards require the fulltime services of one division lineman, 5% of the time and material charged against an electronic maintainer, and 10% of the time and labor charges of an assistant electronic maintainer.

Another railroad, which employs a communications maintainer on each trick around the clock has these facili-

BUS TWO-WAY RADIO receives operational check at NYCTA repair center.

NYCTA CENTRALIZES RADIO REPAIR



ELECTRONIC EQUIPMENT repaired includes PA amplifiers.

PORTABLE RADIO units carried by police receive attention.

ties at its yard requiring communications maintenance: two closed-circuit TV systems, 24-channel microwave terminal, five talk-back speaker systems, one paging speaker system, seven radio systems and 95 portable radios plus yard locomotive radio equipment and base radio stations.

Although there is usually not the daily or weekly attention required of communications facilities at yards as far as maintenance is concerned, the need for maintenance is just as important on the communications side as it is on the signal side.

The quality of maintenance in an automatic yard is important. One road's signal engineer says that a well-trained, competent staff is a must for a well-maintained classification yard. Also, he says: "Keep staff rotation to a minimum by reorganizing the positions to make them as attractive as possible to retain personnel."

Other factors considered important to classification yard maintenance include:

—The use of high quality materials with rigid minimum standards adhered to.

—Surfacing of the classification tracks at least once a year to maintain proper grades.

—An efficient method to remove snow and ice from switches and retarders.

—Methods to keep oil and grease off retarder shoes. However, good rail surface lubrication for curves is warranted.

—Adequate shop facilities and mechanical equipment for handling heavy retarder sections, switch machines, etc.

Speaking of maintenance, a look at the problems of a large transit authority shows that they have the additional task of maintaining almost split-second service to the public. While failures of equipment on a railroad create costly delays, time to restore service is not as critical as it is for mass transit operations. One of the largest two-way radio systems is operated by the New York City Transit Authority. With its bus subsidiary, NYCTA's radio system includes 4,700 radios for buses; 630 radio sets for subway trains; 256 radios for supervisory, emergency and transit police vehicles; over 900 portable two-way radios used by transit police, bus dispatchers and subway personnel; and several hundred base radio stations to link these units to provide system-wide coverage.

NYCTA has recently opened a new repair center in the East New York section of Brooklyn to supply swift replacement and repairs of all types of TA's communications equipment. "It will also result in a considerable saving in cost of maintenance. When bids were sought from outside contractors for repair of equipment, the estimate was about $40 per unit per year. Under this system, the Transit Authority is able to repair the units itself at about $23 per unit per year," said John J. Quinn, assistant general superintendent of maintenance of way.

The new center and its branch at 180th Street and Morris Park in the Bronx have a combined work force of 58, with all electronic equipment maintainers required to have an FCC radiotelephone license. There are two tours of duty to insure that malfunctioning equipment is put back on an operational basis in the minimal amount of time. Estimates are that the center will handle approximately 24,000 units a year, with this figure expected to increase as additional electronic equipment is installed.

Signal maintenance on a transit operation is more severe than on a railroad. One large transit system has a 4-track mainline where over 1,000 trains operate in a 24-hour period. Code relays operate between 800,000 to 1 million operations per day. Periodic replacement on a 90-day cycle relieves the field forces but certainly stretches the shop capabilities. While averaging 90 million operations from a relay is a tribute to the manufacturer and the device, a 90-day replacement cycle approaches the intolerable in a system geared for 10-year shop servicing. Fortunately, solid-state code systems have been developed to solve this problem of relay operation.

However, the maintenance aspect of code systems and the electrical equipment, such as switch machines and automatic train stops and signals remains. One transit authority signal en-

gineer expresses the situation this way: "We find that the maintainability aspect of these systems is paramount in restoring service. The public doesn't care if service is delayed due to a routine event such as ballast in a switch point or if it's a more exotic event such as a defective switching transistor or a hard-to-find 10¢ resistor that has changed in value. We must restore service immediately, if not sooner."

"One great need, he said, is to provide aids to maintenance personnel. "We need comprehensive manuals, complete schematics, visual indications of dynamic as well as static conditions, facilities for slow rate stepping of high speed transmission systems, availability of test points and straight forward packaging with maintainability in mind rather than super high density and miniaturization."

Existing labor agreements on one large transit authority require that signal maintainers service and maintain up to 50 units of equipment. A unit is a complete signal with associated automatic train stop; or a power switch or a combination of the above with interlocking or CTC control machines, relay rooms, power locations and allied equipment. Maintenance on this system is 24 hours daily, 7 days per week because trains are operated continuously.

As for servicing and maintenance of electronic equipment such as radio or microwave, some railroads schedule regular preventive maintenance routines, while others wait for trouble to develop. All, of course, make any tests or inspections required by FCC, FRA or FAA rules and regulations, One railroad, for example, does preventive maintenance testing and adjustment of VHF radio equipment once each six months; of microwave equipment once each month and carrier equipment annually. Also, when trouble exists on a piece of equipment, immediate corrective action is taken.

In the performance of preventive maintenance on VHF radio sets, the road uses gummed labels (red, orange, green, etc.) and assigns one color for a particular six-month period. Whenever a unit is preventive maintenanced, a proper label is attached, and these can be readily seen by personnel when they check mobile units around the yards. Any radio sets with the wrong color label are removed for preventive maintenance and replaced with a unit that has gone through the shop.

Preventive maintenance of microwave equipment consists of maintainers going through the station monthly, checking all electronic equipment performance, setting levels in and out, checking performance of all alarms, control functions, operation of standby power equipment and inspecting its condition, policing grounds, roads, building, inspection of tower, waveguide, dishes, etc.

KERSHAW BRUSH CUTTER can work under and near pole lines.

The annual testing of carrier equipment consists mainly of checking and, if necessary, performing a line-up.

Repair and replacement parts for electronic equipment is as necessary as maintenance. Most railroads keep their communications or radio shops equipped with a sufficient quantity of spares on hand to fill current needs. A radio shop usually carries complete spare radio sets so that bad ordered units can be replaced promptly with operable ones.

One railroad spreads its spare parts and replacement units of electronic equipment around on a division basis. Each division has some small amount of spare equipment on hand, although the accumulation of large emergency stocks is discouraged. Standing orders are carried with some suppliers enabling the railroad to telephone for shipment of equipment and supplies in cases of emergency. Each division carries a certain amount of emergency cable and wire on hand.

And, speaking of wire, one of the continuing maintenance problems is removal of brush and undergrowth along railroad pole lines. Some roads use chemical sprays to inhibit vegetation growth, but with emphasis on pollution in recent years, some railroad communications men see a return to brush cutting. Fortunately, new machines have been developed to cut brush and even small trees. Some operate from the track, while others are rubber-tired vehicles that can be operated close to or under the pole lines.

Railroads having microwave systems find that each electronic maintainer is able to adequately service about six microwave stations in addition to maintenance of other communications equipment such as VHF radio base stations, carrier equipment, etc. Travel time to microwave station sites is considered as well as amount of equipment to be inspected in determining number of stations covered by one man.

One of the larger railroads with extensive microwave facilities makes monthly, quarterly and annual inspections of their microwave stations and equipment. Monthly checks include inspection and voltage measurements of batteries, and equipment. Levels of pilots and test tone on multiplex control channels are checked and recorded.

Quarterly checks are made on all power supplies and are adjusted for proper voltage and ripple. Where vacuum tube equipment is in service, individual tubes are checked and replaced as necessary to meet operating specifications. If overall levels have drifted on pilots and test tone, readjustment is made from end to end to original established standards.

Annual inspections and tests include the following: Towers and antennas are checked for loose bolts, etc. Building and towers are painted as required. Guy wires are checked for tension. Waveguide pressures are checked for any leakage. Frequency and power of transmitters are measured and recorded to meet FCC regulations. Transmitters are linearized and deviated per manufacturer's specifications. Net path loss measurements are made on each microwave hop. Each hop is noise loaded for 240, 300 or 600 channels depending on system capacity. Propane tanks for standby power generators are filled as required in the spring and fall. Any tower or building repairs are done and all operating facilities are put in first-class condition.

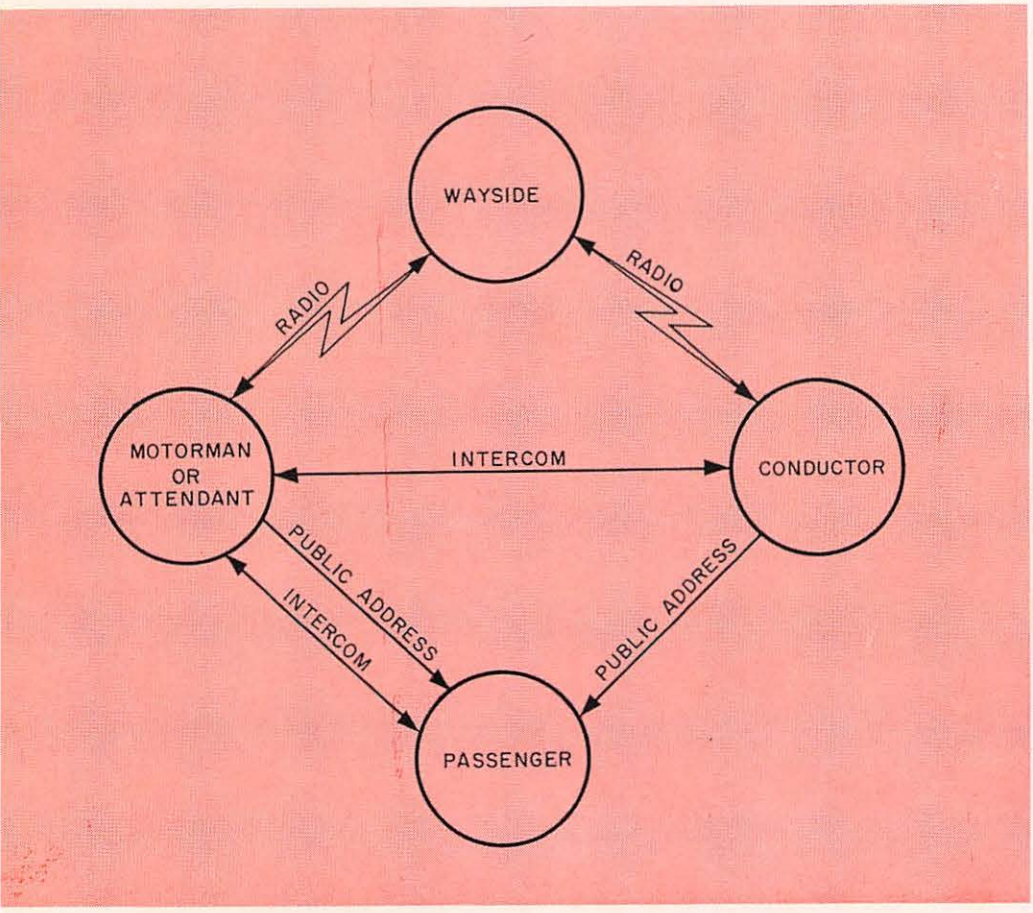
Transit communications has radio,

MANAGEMENT INFORMATION

No longer are commuter railroads and mass transit authorities concerned only with transporting people. Comfort and convenience are also considered important along with the physical act of transportation. Hence, dissemination of information about operations, especially helpful when delays occur, plays a key role in today's transit systems.

Improved operations controls result from extensive use of instant two-way communications between dispatchers, train operators, conductors and law enforcement personnel. Three basic communications systems are being employed by transit authorities and commuter railroads, namely two-way radio, intercommunications and public address systems.

In some cases, it is possible to combine these three systems employing much common equipment, such as power supplies, amplifiers, speakers and microphones, for example. However, some communications experts prefer to keep the radio system separate from PA and intercom equipment. Failure of a common unit shared by radio, PA or intercom systems might cause one or more systems to become inoperable. Radio is generally used for train-to-wayside communications between train crews and operating officials and also law enforcement personnel, so that failure of the radio equipment could be critical. However, intercom and PA systems in trains are often combined using much common equipment. All are designed to improve operations and keep the public informed.



TRANSIT COMMUNICATIONS include intercom, PA and radio systems.

BY ROBERT J. SCHWENDEMAN
MANAGER OF ENGINEERING
PORTABLE SPECIALTIES PRODUCTS
MOTOROLA, INC.

A projected yearly average of 800 rapid transit and commuter cars will be delivered through the 70's. These cars offer speed, safety, convenience and comfort to lure both the suburbanite and the urbanite from the confines of their personal transportation and the already congested highways.

There are a multiplicity of communication modes available for the railroads to choose from. For communication between the wayside and the motorman or conductor, a train two-way radio will allow the train crews to receive required rerouting instructions and information concerning other special conditions. The train can provide information to wayside concerning track condition, fires, defective signals, allowing proper action to be taken immediately. Emergency medical equipment or police can be summoned to meet the train in case of passenger health problems, vandalism or other emergencies.

For the motorman or conductor to communicate to the passenger, a public address system, with speakers and microphones distributed along the length of the train will allow routine or emergency announcements. Provision may be made to switch the receiver output of the two-way radio into the public address system for general announcements from the wayside. Routine announcements may be supplied through the use of professionally prerecorded, programmed tapes keyed at the correct time by track circuits. In addition, background music can be provided between announcements for passenger enjoyment.

Intercom facilities can be provided to allow the conductor to converse with the motorman from stations along the train. Even passenger intercom stations can be provided to allow passenger inquiries of train personnel.

The first system requiring radio equipment unique to the rapid transit and commuter field was designed for the New York Transit Authority in 1965. At that time a transit mobile radio and rack were designed.

This allowed radios to be assigned to motormen instead of to cars. All cars were to be equipped with racks capable

intercoms

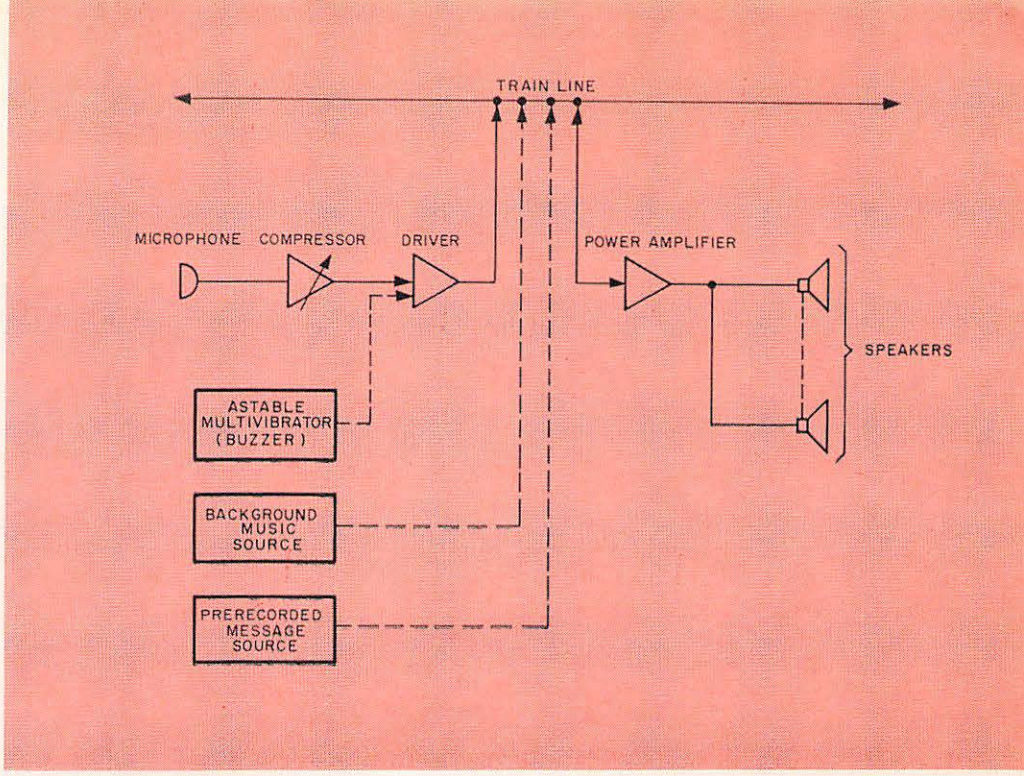
of accepting the radio. The radio is automatically locked in the rack upon insertion; upon removal from the rack a cover plate may be locked in place to prevent foreign material from entering the rack connector. The 12.5 lb radio package contains an 8 watt, 160 MHz transmitter, a receiver with 5 watts of audio capability, a power supply filter and a regulator to maintain performance over the train battery voltage range of 24 to 44 volts. All power, antenna and control connections are made automatically when the radio is inserted into the rack.

The train consists of a number of cars with dormant racks with only one active radio, operable by the motorman. A footswitch and microphone hangup are provided at the motorman for hands-free operation. A switch on the radio allows the receiver audio to be put into the public address system. The antenna for the oldest cars is a roof mounted, low silhouette, slot antenna. Newer cars have a special group plane antenna mounted beneath a fiberglass roof section. The cars to be built by St. Louis Car under the latest Transit Authority contract will have provision for operation of the radio, mounted in an "A" car, from any "A" car in the same train through use of a control panel in the motorman's console. In addition, intercom capability will be provided between control panels on the new cars.

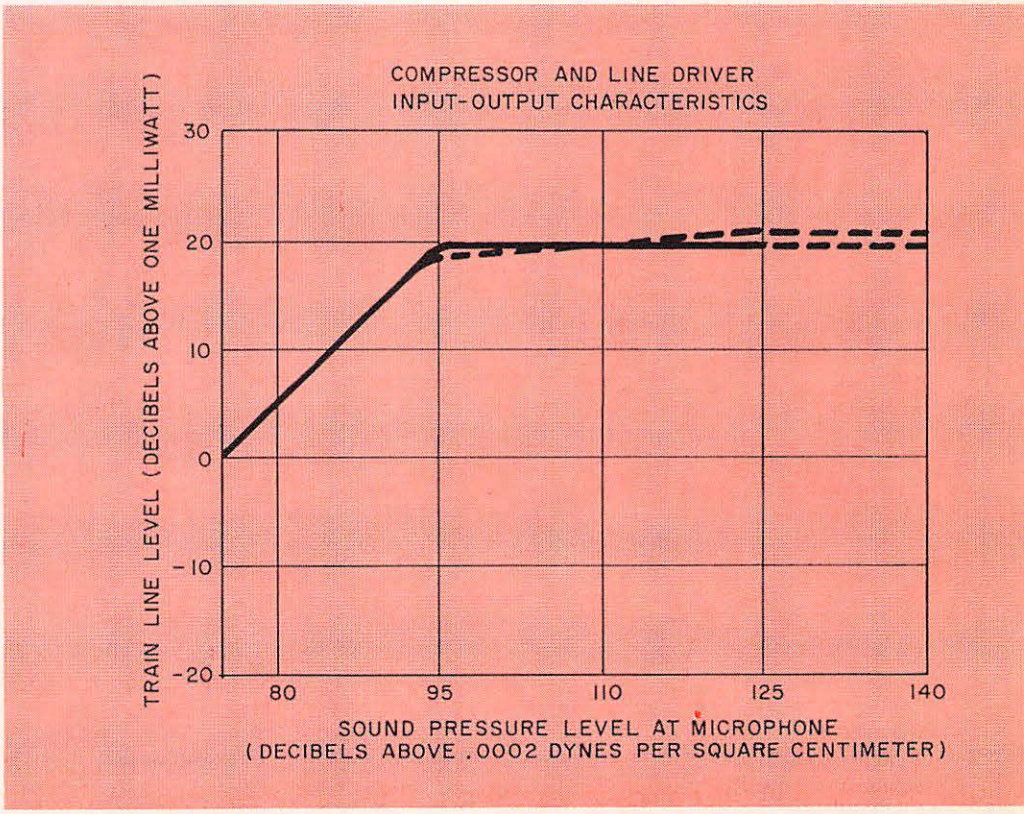
The RF portion of the New York transit system is particularly interesting. The rapid transit system in New York consists of about 30 different lines and branches of combined subway and above ground service.

The above ground system is conventional with 3 base stations and 7 receivers covering the city. Propagation of radio waves within tunnels is extremely poor, requiring a different approach. Satellite base stations are spaced at approximately two-mile intervals into the subways. The antenna input for the base stations are combined in diplexers with the input for companion transit police radio system base stations and then matched to the antenna. The antenna consists of a lossy twin lead extending one mile through the tunnel in each direction from the base. The ends of antennas of adjacent systems are separated by 700 ft. The main console can control individual or multiple two mile segments of the underground system by proper selection of 20 KHz to 200 KHz carriers in the telephone wire line pairs linking all satellite base stations in the train system. A similar distribution system is used for the transit police. An additional control point is provided at some stations, so that trains may be contacted locally. Conventional portable two-way radios are used as base stations in the yards.

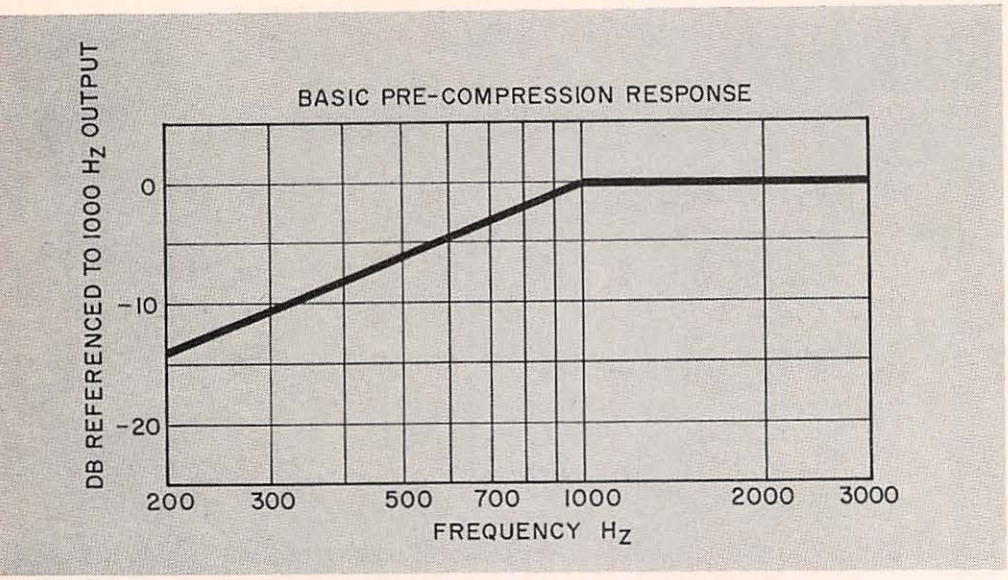
For its new Metropolitans, the Long Island purchased a special radio system consisting of a radio-power supply–control chassis and two custom control heads per married pair. On the train the control heads are located in the cabs of each married pair with the radio and its power supply and control chas-



PUBLIC ADDRESS system (simplified version) includes recordings.



SPEAKER'S VOICE one-inch from microphone has pressure of 110 db.



PRECOMPRESSION FREQUENCY response changes to improve amplifier output.

sis mounted on a modified AAR rack, in a locker along with a public address amplifier. A multiple shielded pair cable and a flexible car to car jumper cable connect the control heads to the locker equipment. The control head, which has been styled to match the interior of the Metropolitan cab mounts to the right and front of the motorman. From this single panel, he or the conductor may operate the radio or make announcements through the public address system. The communications system is enabled by the insertion of a conductor's key or motorman's reverser handle in its appropriate slot. Frequency of the radio is determined at the enabling end of the pair; should both motorman and conductor be operating from the same pair, a priority system disables the conductor's frequency control.

Radio public address announcements may be made by placing the function switch of either control panel in the radio and capitalize to PA position. This connects the radio receiver output to the public address system and automatically chooses the second radio frequency regardless of position of the controlling frequency switch. This insures the Long Island that only the correct channel can be heard through the public address system. The module in the locker consists of a combined radio and power supply control chassis. The radio is a 160 MHz four frequency unit with eighteen watts of transmitter RF output. Two of the transmitter channels have "Private Line" on the carrier. The one half microvolt receiver provides eight watts of audio power, four watts to each control head. The power supply and control chassis contains a spike filter, a regulator to reduce the 20 to 46 volts from the train battery to 14 volts for the radio, and logic for the frequency selection functions.

The new cars on the South Shore Line of the Massachusetts Bay Transit Authority include a totally independent radio system in each cab consisting of a combined control head-radio and a separate filter and regulator power supply. The control head and radio are mounted to the left of the motorman in the car's right collision post. The power supply is mounted near the train's public address amplifier in the left collision post. A specially designed low profile antenna provides the RF path for the system.

The control head includes an intercommunication amplifier capable of talking to other control heads along the length of the train. Additional control heads may join the intercom line on a conference call basis. The control head may, as in other systems, be used to direct radio audio into the public address systems. A switch is provided at the handset hangup to disable the radio "Private Line" when the handset is removed. A decoder to be used for disabling a stop command from the automatic train control is also included within the control head. In use, when the motorman wants a stop command removed, he calls the base station, giving his radio number and asking for 'external release'. The motorman must keep the handset out of the cradle to prepare the decoder to receive the signal. At the base operator's option, a two tone sequential signal is sent to the train, operating the decoder which provides a closure to the automatic train control, thereby removing the stop command.

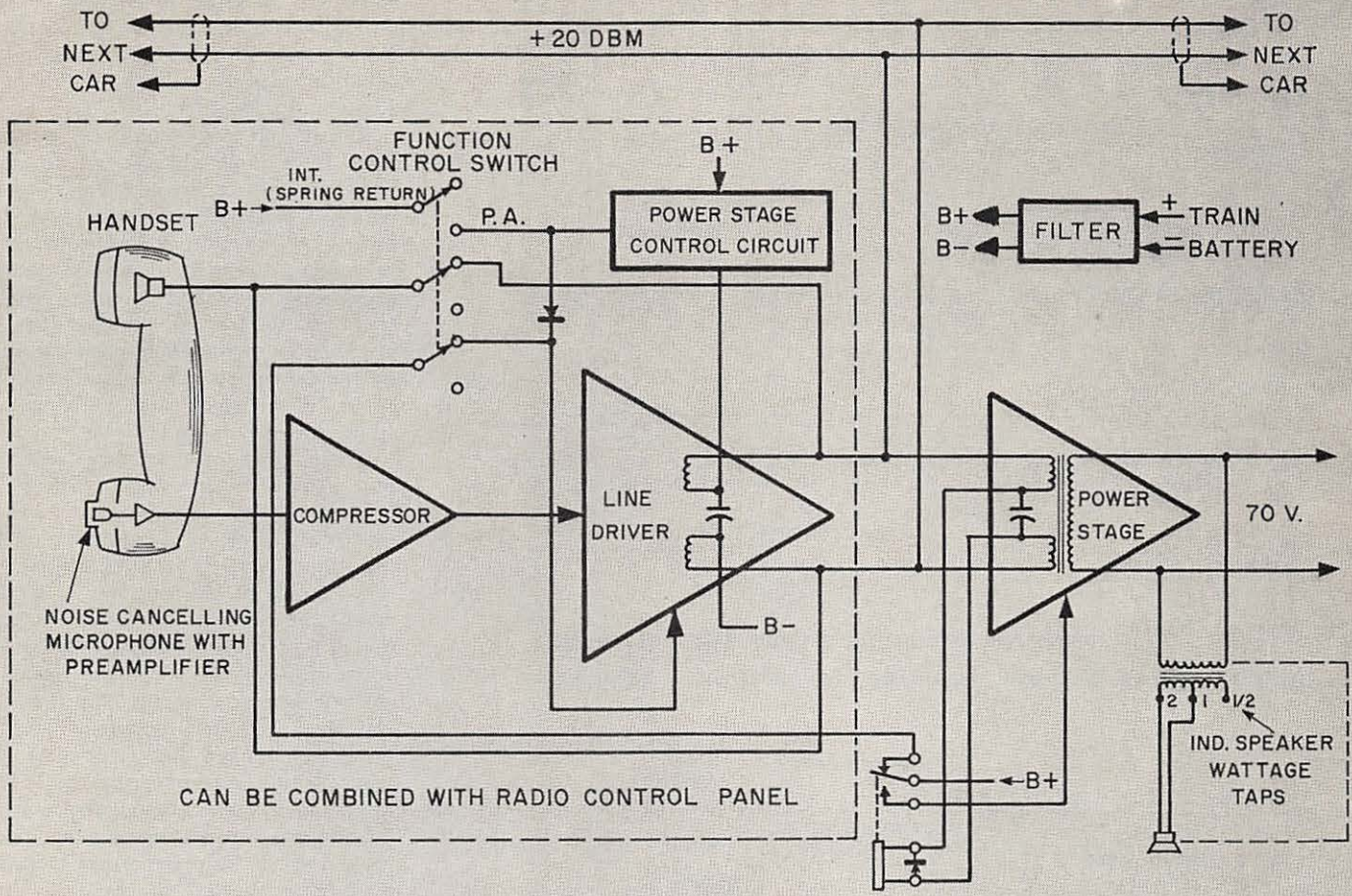
The control head was custom designed to match the interior of the South Shore cars. It flush mounts in the wall of the cab next to the motorman. A white "on" light is controlled by an automatic light dimmer to prevent eye fatigue from a constant bright light at night. Although the radio is normally turned on by insertion of the motorman's reverser handle, an emergency, sealed power switch is available on the front panel. An 18-watt, one-frequency radio is attached to the rear of the control head, making an integrated package. A swing-out bracket is provided allowing the unit to be hung in place with the radio available for minor servicing such as yearly frequency or tuning adjustments.

The power supply mounts to its rack by means of four one-quarter turn fasteners for easy removal from the car. Internally, the supply consists of a spike filter to remove transients from the battery line and a regulator to supply 14 volts DC to the radio and control head.

On 250 cars now being designed by the Rohr Corp., for the Bay Area Rapid Transit District, a control panel in the attendant's area of this train will control the radio, public address system and a unique passenger's intercom system. No longer will the riders have to search for train personnel to assist them. Passenger intercoms will be distributed along the length of the train, one in the "A" cars and two in the "B" cars. Pressing a button on the panel of one of the remote units will lock it onto the passenger intercom line. The rider may now immediately converse with the attendant. When the conversation is completed, the attendant resets the intercom line, placing all intercom units in a standby mode.

Old cars as well as new cars are being considered in the communication revolution of the commuter and transit vehicle. Because of the small size of components in the MBTA system, it was possible to design an enclosure allowing the new train equipment to be retro-fitted into existing MBTA Cambridge-Dorchester cars.

Adapting the Long Island's two control head, one radio approach to existing older cars on the LIRR would have required extensive car modification including pulling of multiconductor cables the length of the train and addition of a flexible jumper between cars of married pairs. Long Island chose a one radio per car approach using a radio chassis identical to that used in the new



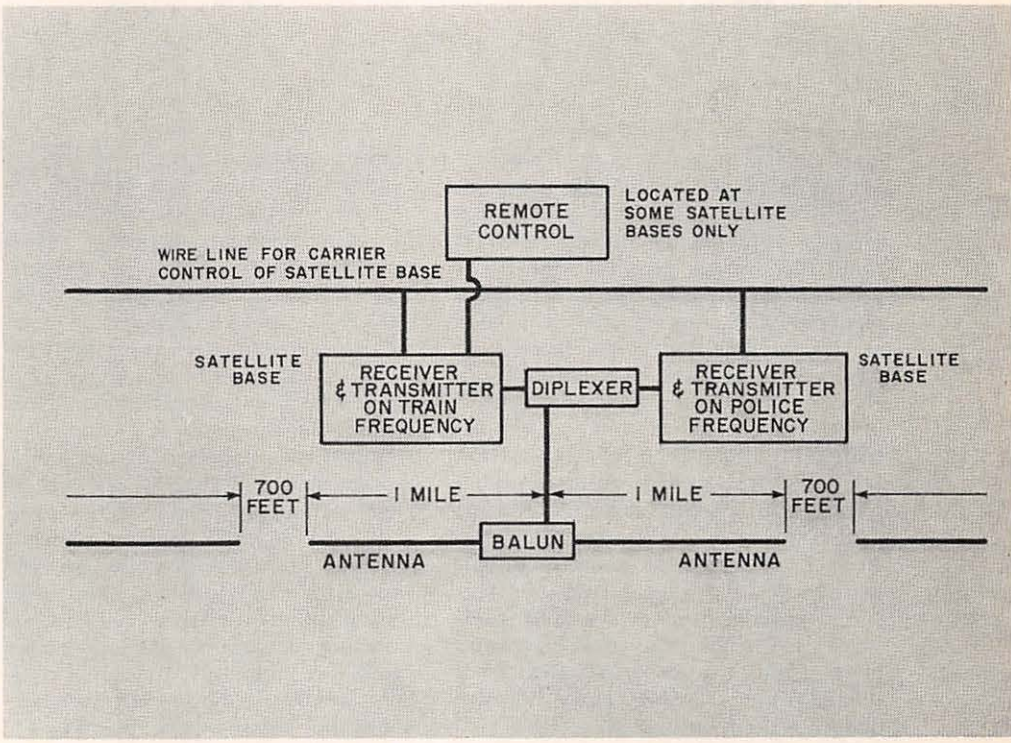
PUBLIC ADDRESS system can be combined with intercommunications using common equipment.

car systems. A much smaller control head will be mounted above the cab windshield with the microphone brought down to the left of the motorman. The control head cable will be routed over the cab ceiling, and through a wall behind the motorman to beneath an adjacent passenger seat where the radio and power supply will be housed.

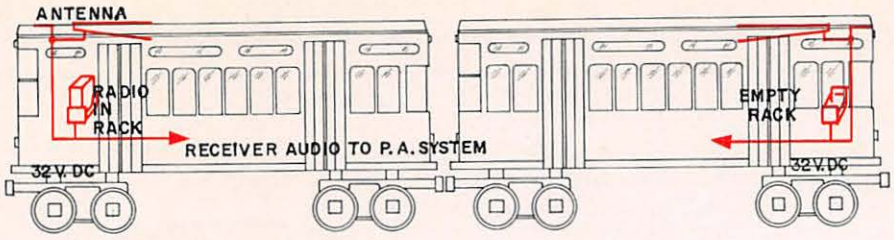
The Port of New York Authority is taking a similar approach on their existing equipment. Here the control head and radio will be combined in a single unit mounting in a locked rack. The radio speaker and power supply are remoted in a convenient location.

The communication system to be used by the Illinois Central includes a standard railroad Motran radio and railroad control head modified to work with the public address system. The heart of the PA system will be modularized 30 watt public address amplifier driving 12 speakers throughout each of the new double decker cars.

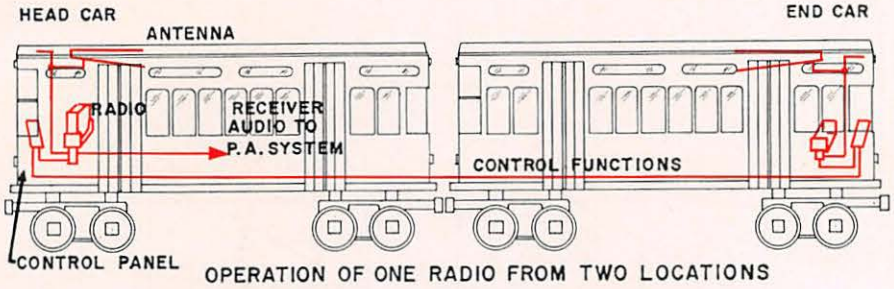
Public address systems must inform or entertain but not annoy. When the average level of a voice message is



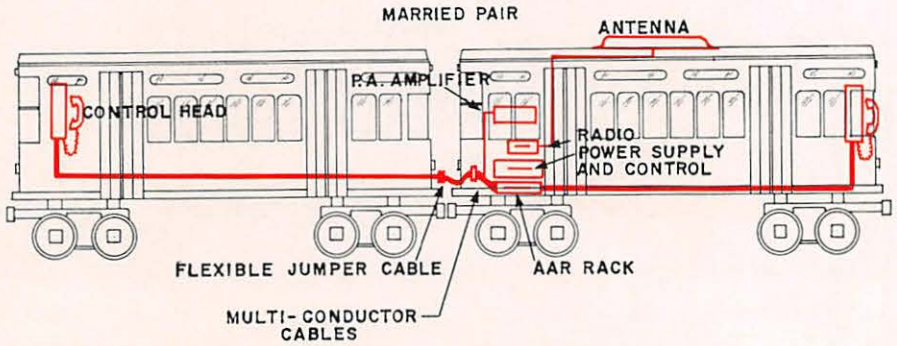
NYCTA SUBWAY RF system uses lossy twin lead in tunnels.



OLDER NYCTA CARS permitted operation of radio from one location only.



NEWEST NYCTA CARS permit radio usage from either end of paired cars.



LONG ISLAND METROPOLITANS have radio and public address systems.

equal to the noise background, assuming while noise, intelligibility may be only 45%. Raising the level of the voice message to about 17 db above or 50 times the average power of the background noise increases the intelligibility to about 85%, approximately the knee of the intelligibility curve. Increasing the level of the voice message to 30 db above or 1,000 times the average power of the noise field will increase the intelligibility to a limit of about 90%. Intelligibility numbers are interpreted from a study by the Harvard Accoustical Labs printed in the Journal of the Accoustical Society of America. Intelligibility never reached 100% in this study partially because the voice messages used in the study were unrelated monosyllabilic words with which even trained listeners would have difficulty under ideal circumstances.

The noise environment in a train is somewhat different from white noise. Readings taken in the car on the "A" weighted scale of a noise intensity meter will correlate to some degree with the voice masking properties of the noise. Sensitivity of the "A" weighted scale of a sound meter falls off below 1000 Hz at about 6 db per octave. The "C" scale of the meter is essentially flat. Sound measurements are taken in db above 0.0002 microbar, commonly considered the threshold of hearing. "A" weighted measurements in the interior of a car may vary from 60 db for a car when stationary, 75 db when moving at 30 mph with the windows closed to over 100 db weighted sound pressure level with the windows open while passing other trains or with wheels squealing in turns. Announcements should be limited to times when the "A" weighted noise measurements would be below about 80 db. This would require a peak sound pressure level capability of the sound distribution system of 90 db above the threshold of hearing for any sort of intelligibility. Any system of greater sound capability would, in all probability, be annoying to the rider.

Early train public address systems were little more than a microphone, sufficient gain to drive a few speakers with a distribution system sampling some of the output to the speakers and presenting it (and its distortion) to amplifiers on other cars; some systems trainlined the microphone or the speakers line. Some amplifiers were powered by their own separate dry cell supplies to avoid the noise and high voltage spikes present on the train battery.

These early systems have evolved into a sophisticated approach capable of applying broadcast quality audio at controlled levels to the interior of the car. Simplified, the public addres system consists of two portions, a section used to feed the communications train line at a power level of 10 to 100 milliwatts and a series of power amplifier and speaker systems operating from the train line. The first section, which can be considered the source, consists of a microphone, compressor and line driver, in a live announcement system. Additional sources supplying background music or prerecorded messages may be connected to the train line. These may be prioritized through the use of DC voltages superimpressed upon the audio train line. A buzzer circuit will be included in the Illinois Central's system to alert crew members to certain announcements.

A compressor stage is required to allow for variations in the input to the microphone. The compressor has a linear input-output characteristic until the input level reaches the knee of compression. Above the knee, the output would ideally remain constant to the maximum realizable input to the microphone. Actual circuits will show a slight rise in output over the compression range. The compression range should be centered about an input sound pressure level of 110 db or approximately an average speaker's voice at about one inch from the microphone. Fifteen db of compression should be allowed for variance in individual speaking levels and an additional 15 db for variance in microphone position. If the microphone is part of a handset, the compression knee may be moved to a higher level because the position of the microphone becomes better controlled. This is desirable to help prevent noise bursts due to increased system gain during long pauses between words when the system will fall out of compression. Noise cancelling microphones can provide another solution to microphone noise pick up problems.

Energy density in the human voice

tends to peak at the low end of the voice spectrum and decreases at about a 6 db per octave rate above the frequencies of the peak level. The precompression frequency response of the system can be altered as to better utilize the output capabilities of the amplifier. Rolling off the energy below 1,000 Hz tends to flatten the energy curve preventing the compression level from being determined by the peak in the voice spectrum. This allows a higher average output from the system.

Tests have shown that the higher resultant output coupled with the shown frequency response can improve intelligibility. The desired response can be achieved in the microphone itself or in circuitry before the compressor.

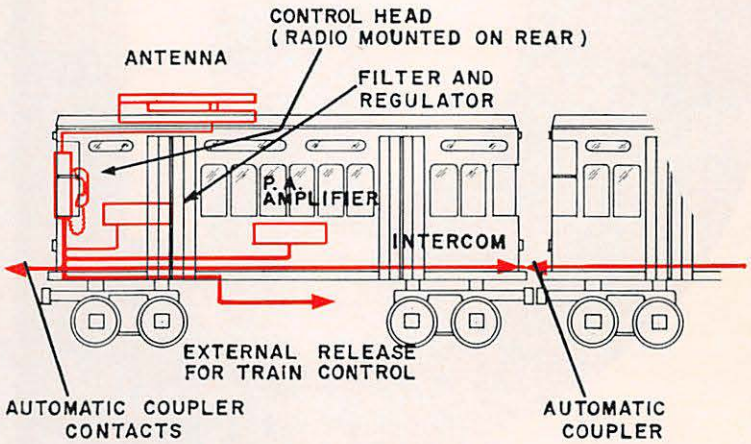
The line driver must be capable of providing at least 100 milliwatts of power to a fairly low impedance train line. Because the train line impedance changes with train length, the line driver cannot be matched to the line. If the source impedance is not low, the line level changes and corresponding sound level changes in the car will be too great as the length of the train is changed. For a 12-car train with a nominal 600-ohm train line, the source impedance of the line driver should be held to below about 30 ohms and the loop resistance per car of the train line should be held below about 5.4 ohms to insure a less than one db change in sound level within the car from the PA system from a full 12-car train to a single car. This is far from being matched.

The power amplifier and speaker system should have sufficient capabilities to provide a peak undistorted sound pressure level, averaged over the listening positions of 90 db. This would require at least eight efficient cone speakers spaced along the length of an 85-ft car, with two watts of audio into each. Input impedance of the amplifier should be large enough to allow the train line to operate at its nominal impedance for an average length train. The output should be to a constant voltage distribution line with 70 volts corresponding to full output of the amplifier. The output stage should be protected against damage due to accidental open or short circuits on the speaker line.

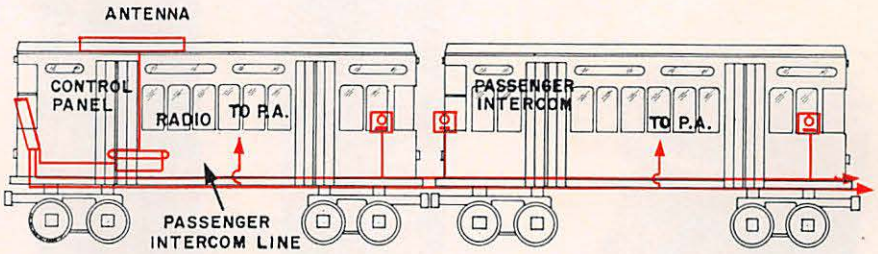
The public address system can be combined with intercom system by using the same microphone compressor and line drive as the source for both functions. A train line shielded pair can be saved by sharing the line, in a no background music system, is prioritized over the intercom system to prevent intercommunications from accidentally being heard by the passengers. The source can be combined with the radio control panel to allow one handset to be used for radio, PA and intercom functions. In addition, it may be possible to use the compressor to some advantage in the radio system.

The filter shown at the upper right side of the diagram provides protection against high voltage spikes on the train battery. These spikes have always been a major problem in the design of railroad radio equipment. They typically are generated by control relays, buzzers, and inverters on the cars. Observations of spikes on rapid transit cars include 1,000-volt pulses to 0.2 millisecond duration, 200-volt pulses of a few microseconds and 50-volt pulses of as low as 20 nanoseconds. In one case, repetitive line to ground faults placed 600 volts continuously in the battery. Because we are not always there to observe the largest of the spikes, a margin of safety must be built into the design of the filter. Protection against a 2500 volt, 0.2 millisecond pulse with total energy when applied line to line of 150 watt-seconds has proved to be adequate. In addition, 1,000 volts continuous DC protection would be desirable. The components required in a filter to absorb an energy of 150 watt seconds with only a few volt pulse at the output are not small.

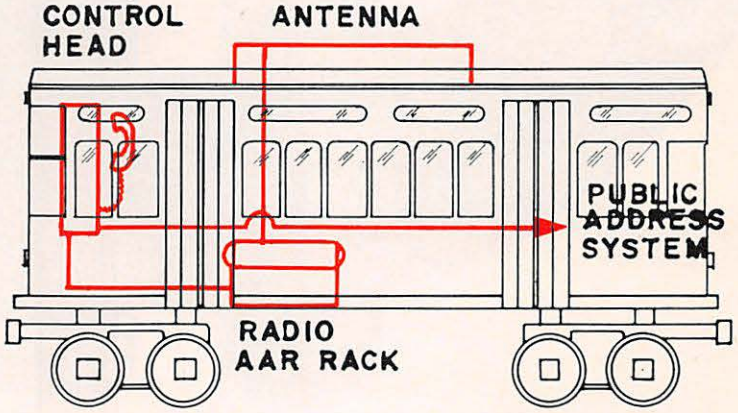
The tubular electrolytic capacitors used in the radio power supplies discussed earlier are about 5" tall, the



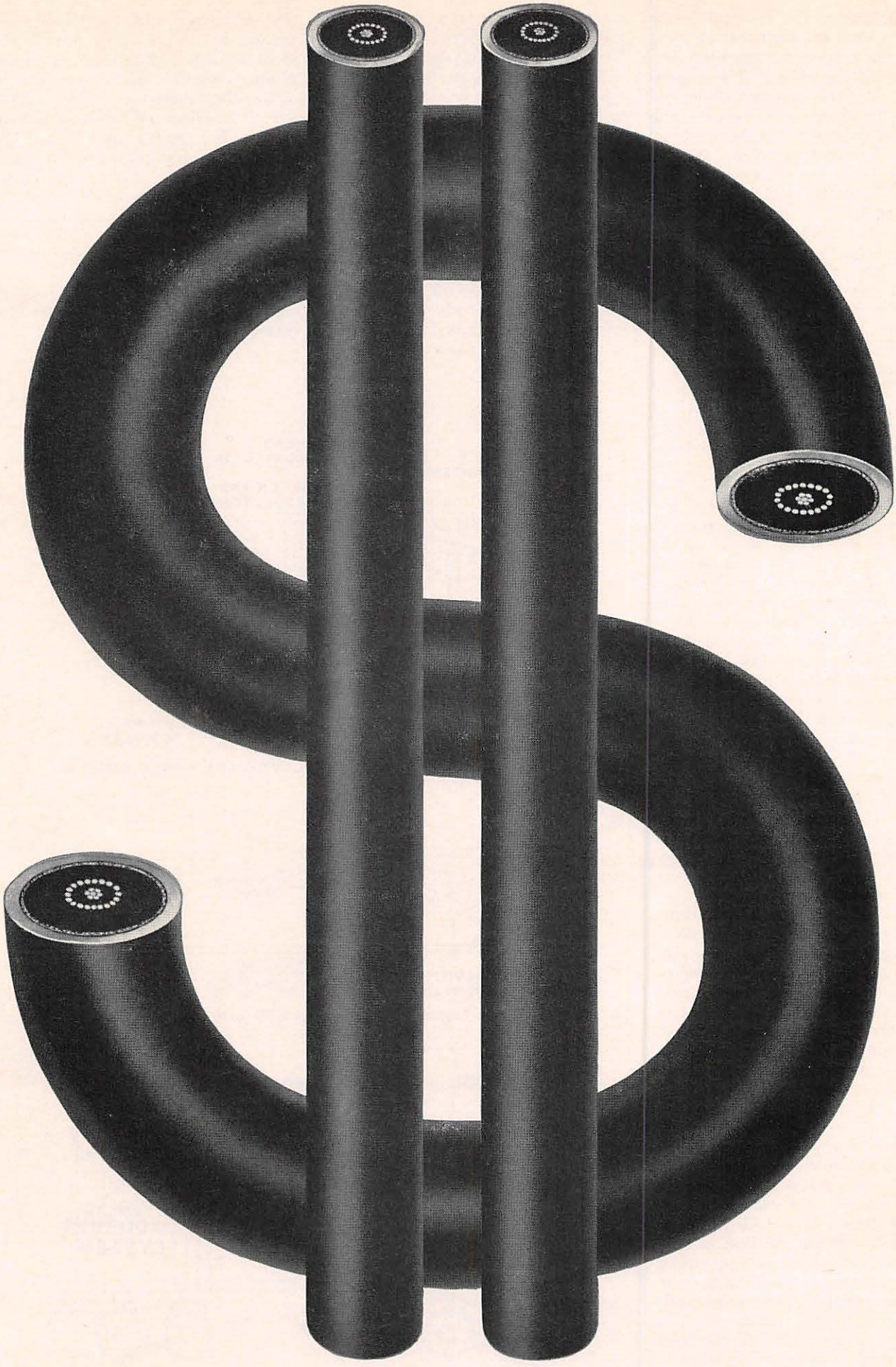
SOUTH SHORE CARS of MBTA have totally independent radio in each cab.



BARTD CARS in San Francisco will have radio, PA and intercoms. *



ILLINOIS CENTRAL commuter cars will have radio and public address units.



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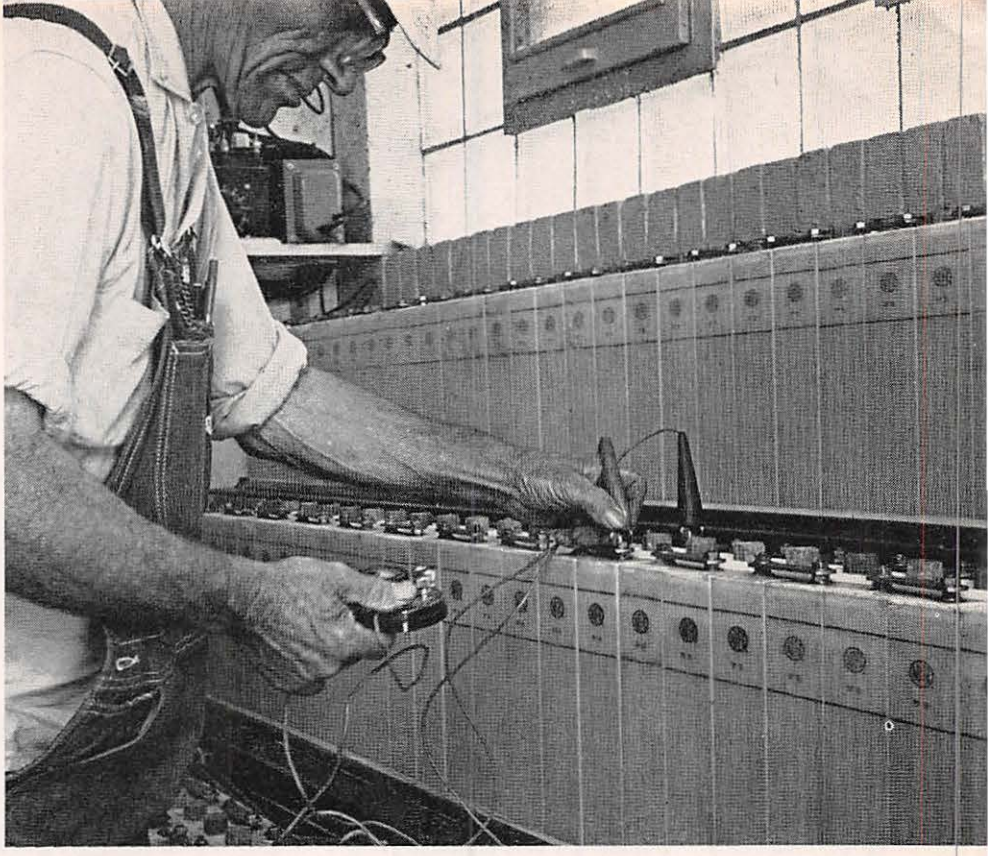
chokes are about 3½" tall.

Another serious problem on trains, is component fatigue due to vibration. Testing the unit on a vibration table can usually pinpoint potential trouble areas. The chassis used in the LI control chassis and power supply has a vertically mounted plug in control board. Originally, the boards were to be secured by four brackets and screws at the base of the board. Two brackets securing the top edge of the board to the chassis frame were added after a vibration test. When vibrated at 40 cycles per second with a total excursion of .060", without top securing, the control board went into resonance. This applies a G force to the components on the board of a much greater magnitude than any components elsewhere on the unit. After addition of brackets to the top of the board, no abnormalities were observed. Another unit designed for less stringent than train applications has a heavy transformer mounted to a preprinted circuit board next to a standing electrolytic unit. When this unit was vibrated at 50 cycles per second, at only one half the total excursion of the train unit tests, the transformer and printed circuit board went into resonance, swinging the adjacent capacitor wildly. The solution was to add chassis mounted brackets to both the transformer and the capacitor. Photographed under vibration, this exhibited abnormalities.

It appears as though the typical commuter or rapid transit train of the next decade will include all three of the basic systems discussed, two way radio, public address facilities and a crew intercommunication system.

The radio will in most cases be a compact package adaptable to both new and old cars. It will probably include "Private Line" to minimize interference in metropolitan areas. Because of system considerations some trains may require a higher power unit similar to the railroad Motran. Flush mount radio control panels will be desirable to match new car cab interiors. In addition, select functions on the train will be able to be remotely controlled by the wayside via the radio.

The public address system will be integrated to some degree with the radio system. This may be to as light a degree as allowing the radio receiver audio to be switched into a separate complete public address amplifier. Other systems may choose to integrate the live announcement source portions of the public address amplifier with the radio system control panel to allow for a single control station. A music source and a programmed announcement source may be added, one per train to provide a somewhat nicer atmosphere for the rider.



CELL VOLTAGES should be measured and recorded once each year.

BATTERY MAINTENANCE:

Care for nickel-cadmium

BY A. H. LINDSAY
SERVICE ENGINEER
NIFE INCORPORATED

To obtain good service from Nife nickel-cadmium storage batteries, the following procedures should be followed:

At the time of installation, check for proper polarity; cells normally are series connected (positive to negative). Make sure all electrical connections are tight. Keep the battery clean and dry. Never use solvents of any kind to clean plastic cells. Vent caps must always be closed during operation.

Maintain electrolyte level. Addition of water is required in normal service. Use only distilled water. Do not allow electrolyte level to drop below plate tops. Do not overfill cells; wipe away water spilled on cells and trays. Check electrolyte level of steel cells with the Nife electrolyte level tester. Hydrometers, filler bulbs, and other tools used with lead-acid batteries must not be used to service Nife batteries. CAUTION: acid will destroy the Nife battery.

Never use a match or other open flame near the battery to check electrolyte levels, Avoid sparks and don't drop tools on the battery. Alkaline electrolyte is a strong caustic. If electrolyte is accidentally splashed on the skin or clothing, apply boric-acid solution or flood with water.

Maintain proper charge. Batteries in "float" service should be charged at between 1.40 and 1.42 volts per cell. Batteries in "trickle" service should be charged at a current of 1 milliampere per ampere-hour of capacity of the battery. Batteries discharged frequently should receive an occasional periodic "high-rate" charging.

On arrival inspect each cell for possible damage in shipment. Check electrolyte levels. Small quantities of electrolyte which may have seeped around shipping seals should not be of concern, as long as electrolyte covers plates. However, if large amounts of electrolyte have been lost in shipment, so that plate tops are exposed, it will be necessary to fill to the proper level with electrolyte. If no electrolyte is available, add only enough water to cover plates. Premixed electrolyte of proper specific gravity is available from Nife.

Nife nickel cadmium storage batteries perform best when maintained on continuous "float" charge. Control

Cell Type	Capacity at 8-Hour Rate (ampere-hours)	7-Hour Charge Current (amperes)	Electrolyte Level Above Plate Tops (inches ±0.25)	Liquid Electrolyte Per Cell (quarts)
Plastic Cells (show maximum and minimum electrolyte level lines)				
RP-10	9.6	2.0	1.00	0.23
RP-16	16.0	3.4	1.75	0.38
RP-29	29.0	6.0	1.75	0.56
RP-43	43.0	9.0	1.75	0.78
RP-57	57.0	12.0	1.75	1.06
RP-91	91.0	19.0	2.25	1.51
RP-120	120.0	25.0	2.25	1.88
RP-168	168.0	35.0	2.25	1.78
RP-197	197.0	41.0	2.50	3.70
RP-221	221.0	46.0	2.50	3.54
RP-240	240.0	50.0	2.50	3.40
RP-278	278.0	58.0	2.50	3.07
RP-308	308.0	64.0	2.50	6.00
RP-336	336.0	70.0	2.50	5.70
RP-403	403.0	83.0	2.50	5.50
Steel Cells				
RS-86	86.0	18.0	2.00	0.82
RS-115	115.0	24.0	2.00	1.04
RS-144	144.0	30.0	2.00	1.28
RS-168	168.0	35.0	2.00	1.50
RS-197	197.0	41.0	2.00	1.70
RS-221	221.0	46.0	2.00	2.02
RS-240	240.0	50.0	2.00	2.23
RS-278	278.0	58.0	2.00	2.44

CELL DATA covers 23 types.

batteries

and indication by voltage is preferred to constant-current charge. A constant-potential, current-limited charger is usually preferred. When using a a charger employing a voltage-regulated "float" setting and either automatic or manual "high-rate" capability, the "float" voltage is usually set at 1.40 to 1.42 volts per cell with the "high-rate" setting at 1.55 (±0.05) volts per cell.

Cells on "float" charge should always be held at a minimum of 1.40 volts per cell. Where discharges are small and for short periods, this voltage is sufficient to restore the battery as well as to maintain the battery fully charged. At this minimum "float" voltage, water additions will be required infrequently, probably no more often than once every two or three years. This minimum "float" voltage setting is usually recommended for track circuit service.

When the loads on the circuit are heavier, such as in grade crossing protection, it is good practice to increase the charging voltage on the battery to maintain a somewhat high charging current. An average of 1.45 volts per cell is usually considered a maximum. Charge will be restored quicker at this voltage, within the capability of the battery charger.

Nife batteries which will be operated at low ambient temperature (zero degrees F and below) require special electrolyte of 1.200 (±0.010) specific gravity. New batteries for such service will be factory-filled with such electrolyte and will be so tagged. Batteries ordered for normal temperature operation, but which will be exposed to continuous low temperatures of zero degrees F, can easily be refilled with high-specific-gravity electrolyte.

Care should be used when changing electrolyte, because the electrolyte in Nife nickel cadmium battereis is alkaline. It is a solution of potassium hydroxide (KOH) and distilled water. Standard specific gravity is 1.180 (± 0.010) and remains constant, independent of battery state-of-charge. Thus, hydrometer readings are not required.

Alkaline electrolyte is a strong caustic. Goggles and rubber gloves should be used to protect against accidental splashing during handling of the electrolyte. If electrolyte comes in contact with the skin, apply a boric-acid solution or flush with plenty of water.

Remove the vent plugs or open the vent caps (working on single cells or group or tray of cells at one time) and invert the cells to dump the electrolyte. Support the cells in the inverted position (such as by means of a pair of 2x4's) and allow to drain for one minute. Right cells. Then immediately pour in the new electrolyte, filling to the prescribed maximum level; to the upper line on plastic cells or to the maximum level on steel cells as indicated on the level tester. NOTE: Do not allow cells to remain empty of electrolyte for more than 5 minutes. If this precaution is observed, it will not be necessary to discharge the cells before dumping.

After filling, add Nife-Oil to each cell to provide a layer approximately ⅛ inch on top of the electrolyte. Close the vents and rinse off cells with clean water. Wipe each cell dry. Recheck all terminals for tightness. Coat all terminals and exposed metal parts with Nife-Cote, which forms a protective coating. Battery is now ready to be returned to service.

To maintain the proper level of electrolyte add only distilled water. Electrolyte level must not be allowed to fall below plate tops. Exposure of the plates to the air may cause irreparable damage. It is not necessary to add small amounts of water frequently in an attempt to hold the level "on the line"; add water only when necessary to avoid going below the low-level line. Cells should not be overfilled, since wet batteries can result in grounds, false relay operation, and possible electrolytic action between steel cells.

CAUTION: Acid must not be allowed to contaminate the electrolyte of a Nife battery.

The grayish-white "crystalline" deposits which may appear on cell tops are not corrosive in any way and cannot damage the battery; nor can the deposits affect the integrity of electrical connections. The deposits are easily dissolved and washed away with clean water. The plastic vent caps should be washed under a faucet or cleaned in a pail of water. After cleaning and thorough drying, recoat cell tops with Nife-Cote.

CAUTION: Never use solvents or cleaning compounds of any kind to clean batteries. Certain solvents can damage plastic cells. Use water only.

It is suggested that individual cell voltages be measured and recorded once each year. Comparison of these voltage readings from year to year will give the best indication of proper system operation. Should cell voltages be found low, indicating an undercharged battery, the charger setting should be adjusted accordingly. Avoid high cell voltages. This results in excessive water loss and the need for frequent watering.

Cell voltages will normally be uniform within ±0.05 volts. A wide range of cell voltage readings may indicate the need for a "high-rate" charge to restore all cells to their fully charged condition.

The maintenance schedule for batteries that will operate at low temperature (zero degrees F and below) should include an inspection before the onset of winter. Water should be added in the Fall to ensure proper mixing before cold weather.

Avoid adding water to batteries during winter because there is the possibility that the water may not mix with the electrolyte. However, in an emergency and if plate tops are exposed, add only a minimum amount to cover the plates. If possible, adjust the charger output temporarily to the maximum "high-rate" setting to assist in the mixing. Then, after 24 hours, reset the charger to its normal setting.

INTERCHANGE DATA will be captured by ACI scanners located at 40 strategic locations in the Chicago Terminal District, such

Can ACI be a decongestant for

To provide effective control of freight cars in a terminal area is a problem faced by many railroads. In the Chicago Terminal District a solution is near--at least if action is taken upon recommendations of the General Managers' Association ACI task force. Created to study the interchange problem and come up with a solution for effective control, the task force is recommending the installation of an automatic car identification interchange and information system. Objectives of the system are:

(1) Maintain a central interchange bureau where the formal interchange records will be produced, distributed and recorded for all railroads.

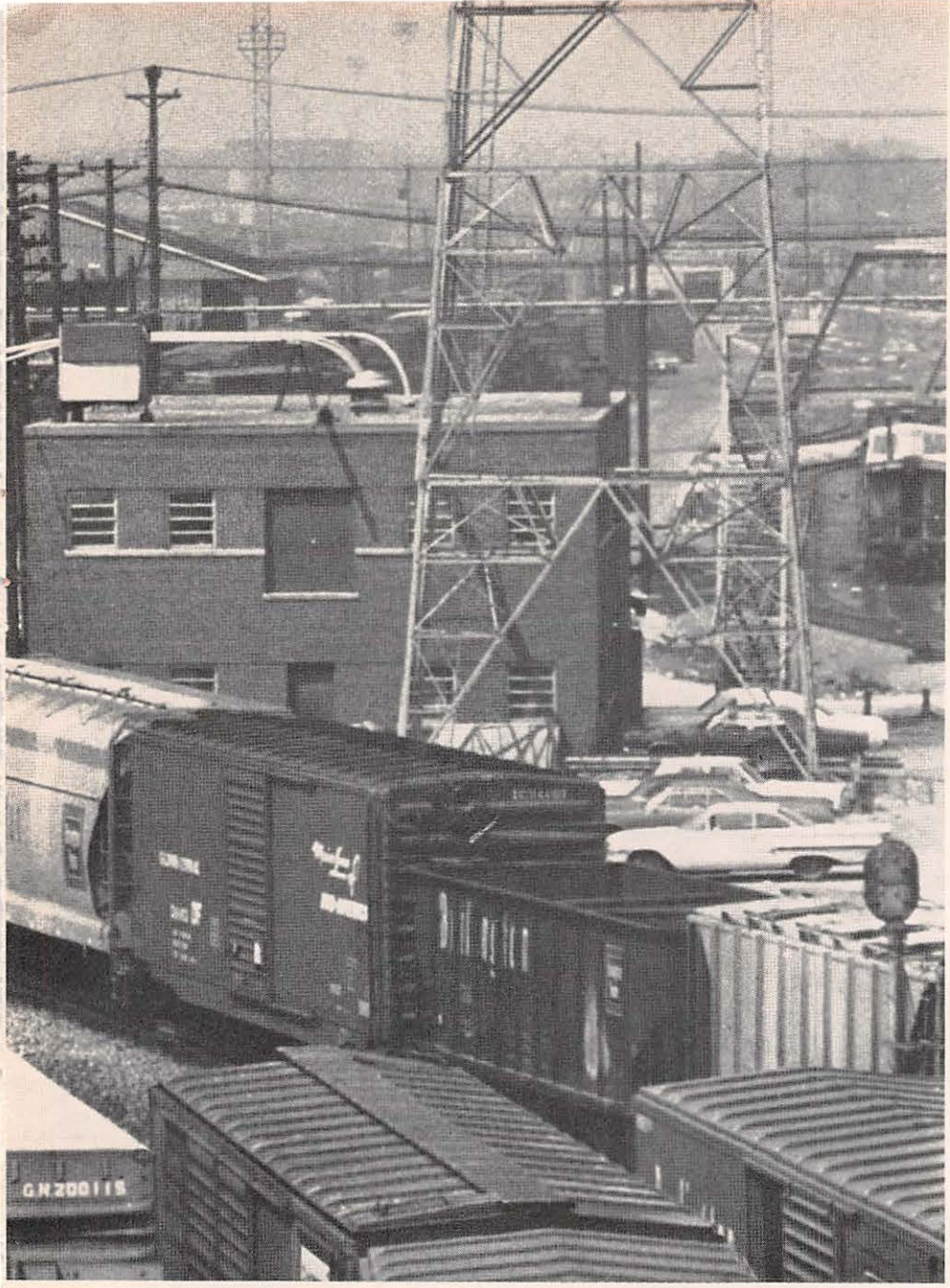
(2) Provide accurate and understandable information on cars involved in ACI scanner movements.

(3) Report on a real-time basis advance information on cars moving between railroads or past scanners, to the location desired by the interested railroad.

(4) Provide an information bank of train, transfer and car moves throughout the Chicago terminal.

The hardware to provide the input for such a system and do the processing will consist of 109 ACI scanners and 100 decoders installed at 40 strategic points along CTD's 7,689 miles of lines. Scanners will monitor about 90% of the 25,000 interchange cars per day operating in more than 1100 trains. The system design recommended is a central computer site with buffered scanners and critical central site functions duplexed. Computer equipment will consist of IBM 2040 processing units, model 2415 magnetic tape and control units, and 2703 transmission control units as key elements. Selection of IBM equipment is because of the compatibility with model 360 computers. Nineteen of the 22 GMA member roads are using 360 computer configurations.

The task force report recommends leasing ACI and data processing equipment. Monthly costs would be $120,-800 including lease maintenance for the ACI equipment. An alternate is sug-



as this one where a transfer cut is being scanned.

ACI FOR 29 RAILROADS

Twenty-two member roads in Chicago General Managers Association will participate in the ACI interchange and information network.

- Baltimore & Ohio, including Baltimore & Ohio Chicago Terminal
- Belt Railway of Chicago
- Burlington Northern
- Chesapeake & Ohio
- Chicago & Eastern Illinois including Chicago Heights & Terminal Transfer
- Chicago & North Western
- Chicago & Western Indiana
- Chicago River & Indiana
- Elgin, Joliet & Eastern
- Erie Lackawanna
- Gulf, Mobile & Ohio
- Grand Trunk Western
- Illinois Central
- Indiana Harbor Belt
- Louisville & Nashville
- Milwaukee Road
- Monon
- Norfolk & Western
- Penn Central
- Rock Island
- Santa Fe
- Soo Line

Seven other railroads, non-members of the Chicago GMA, desire to participate in the ACI information network.

- Chicago & Illinois Western
- Chicago Produce Terminal
- Chicago Short Line
- Chicago, South Shore & South Bend
- Chicago, West Pullman & Southern
- Illinois Northern
- Manufacturer's Junction

railroad terminals?

gested in which GMA would set up its own ACI maintenance force. Under this plan, the monthly cost would come to $112,900. Member roads will be assessed a one-time charge for scanner site preparation and installation amounting to $560,300. If GMA assumes scanner maintenance, set-up expenses (a one-time charge) will come to $74,400.

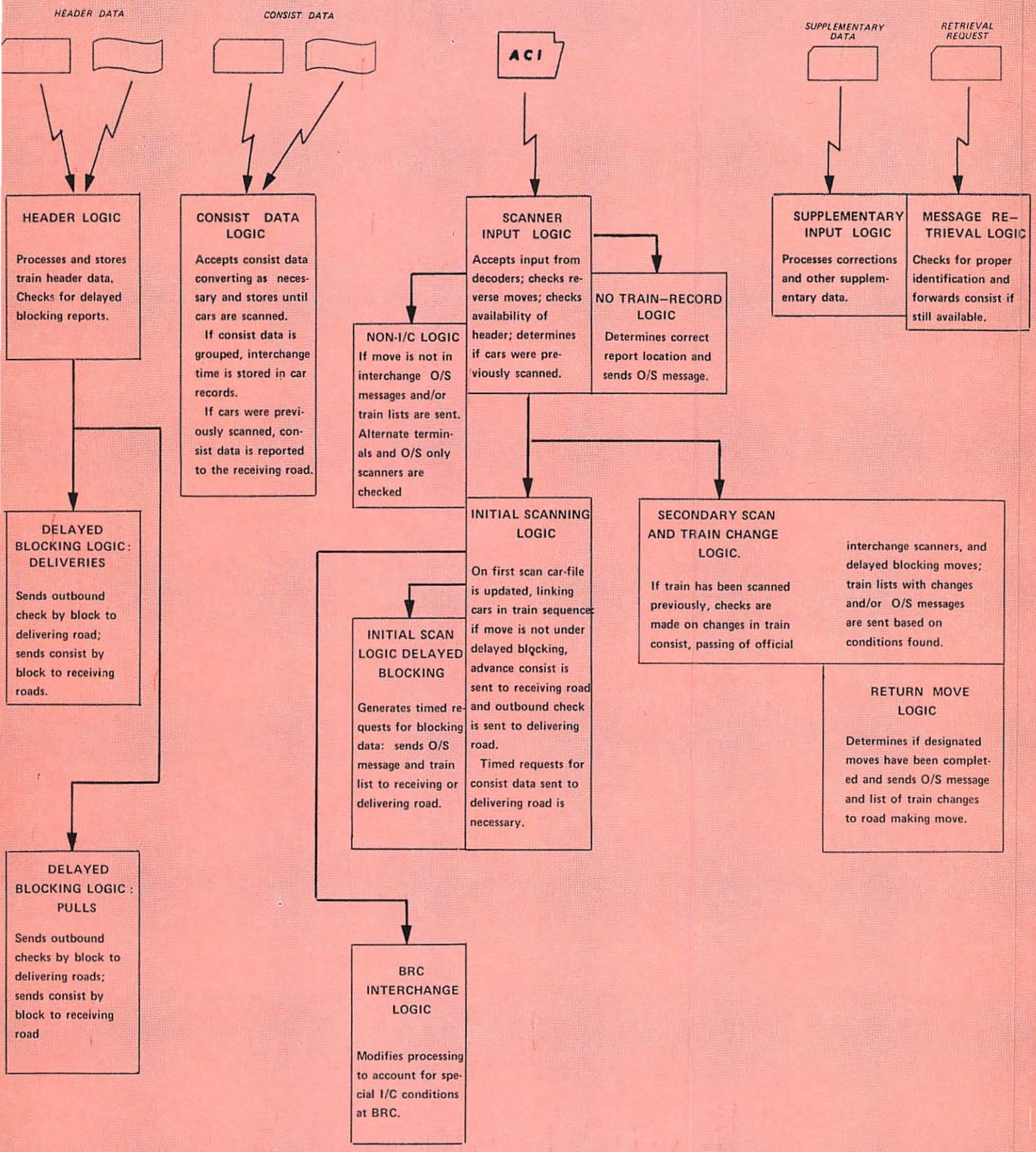
Potential savings are estimated to be $10,750 per month per railroad. Clerical labor savings, notes the report, can be expressed in terms of reduced interchange processing costs and reduced yard office costs resulting from advance consists. The GMA-ACI interchange and information network will produce the official interchange between railroads based on cars actually scanned at the established interchange points.

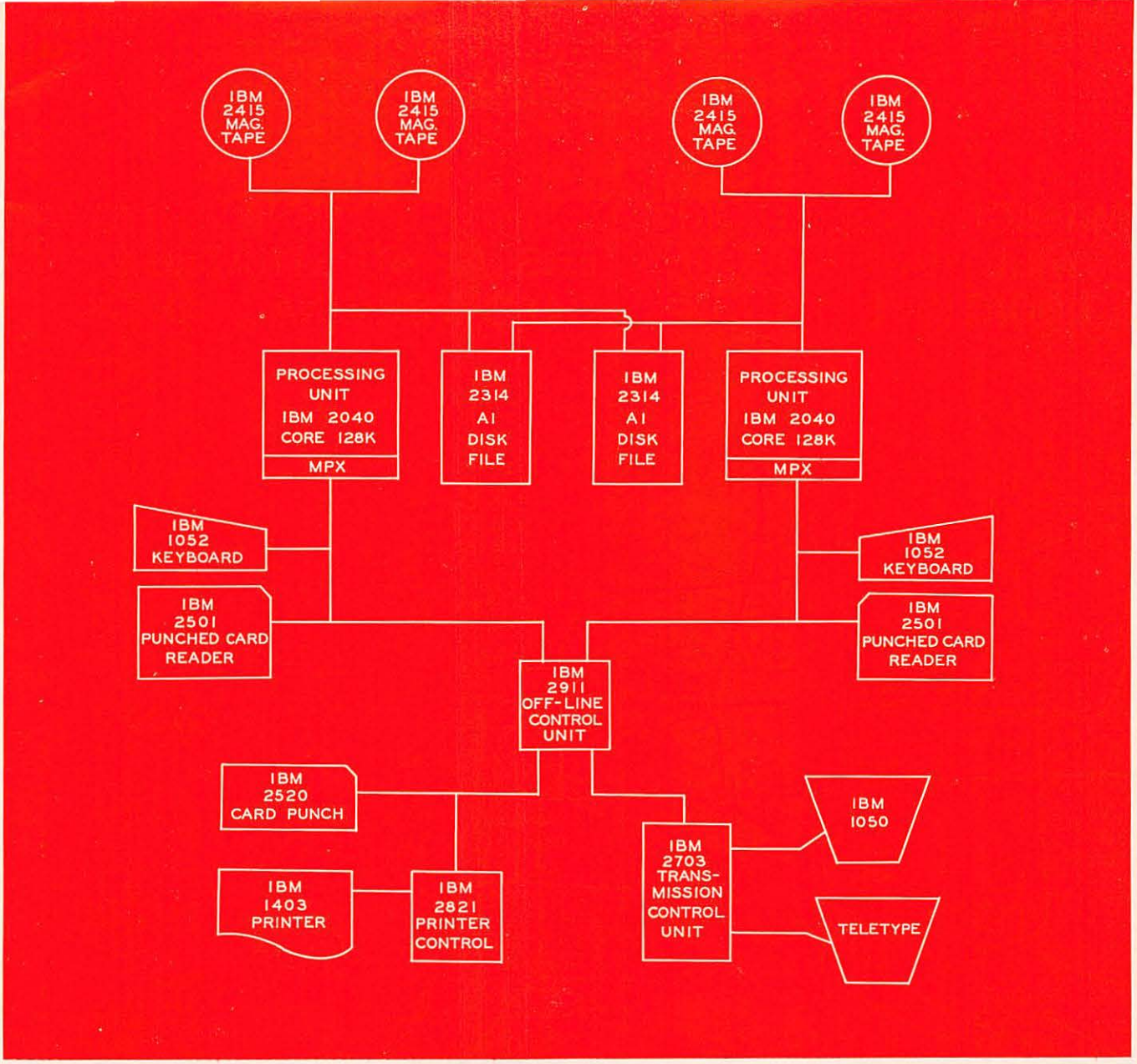
Here, for example, is the equipment required for one road, and how other ACI equipment plays a key role in this road's operations. Information on Gulf Mobile & Ohio train and car movements are generated from 10 scanner sites containing 16 ACI scanners. On the GM&O, there would be 2 scanners at 1 site. At 5 other sites there are 7 scanners viewing GM&O movements off their property. At 8 sites with 10 scanners off of GM&O property, there are cars destined for the GM&O moving in connecting line trains and transfer moves that will be scanned.

MANAGEMENT INFORMATION

Twenty-two railroads in the Chicago terminal area are now studying a proposal made by their own special task force for installation of an automatic car identification interchange and information network. The task force, working for the General Managers' Association, has just completed a massive report outlining how such an ACI network could be installed, including benefits to be obtained. Data from scanners at 40 sites would be fed to a central computer for processing and dissemination to participating roads. Action on the report is expected about November 1, 1970.

SYSTEM LOGIC FLOW RELATIONSHIPS


HEADER DATA
CONSIST DATA
ACI
SUPPLEMENTARY DATA
RETRIEVAL REQUEST
HEADER LOGIC
Processes and stores train header data. Checks for delayed blocking reports.
CONSIST DATA LOGIC
Accepts consist data converting as necessary and stores until cars are scanned.
If consist data is grouped, interchange time is stored in car records.
If cars were previously scanned, consist data is reported to the receiving road.
SCANNER INPUT LOGIC
Accepts input from decoders; checks reverse moves; checks availability of header; determines if cars were previously scanned.
SUPPLEMENTARY INPUT LOGIC
Processes corrections and other supplementary data.
MESSAGE RETRIEVAL LOGIC
Checks for proper identification and forwards consist if still available.
NO TRAIN–RECORD LOGIC
Determines correct report location and sends O/S message.
NON-I/C LOGIC
If move is not in interchange O/S messages and/or train lists are sent. Alternate terminals and O/S only scanners are checked
DELAYED BLOCKING LOGIC: DELIVERIES
Sends outbound check by block to delivering road; sends consist by block to receiving roads.
INITIAL SCANNING LOGIC
On first scan car-file is updated, linking cars in train sequence; if move is not under delayed blocking, advance consist is sent to receiving road and outbound check is sent to delivering road.
Timed requests for consist data sent to delivering road is necessary.
SECONDARY SCAN AND TRAIN CHANGE LOGIC.
If train has been scanned previously, checks are made on changes in train consist, passing of official interchange scanners, and delayed blocking moves; train lists with changes and/or O/S messages are sent based on conditions found.
INITIAL SCAN LOGIC DELAYED BLOCKING
Generates timed requests for blocking data: sends O/S message and train list to receiving or delivering road.
RETURN MOVE LOGIC
Determines if designated moves have been completed and sends O/S message and list of train changes to road making move.
DELAYED BLOCKING LOGIC: PULLS
Sends outbound checks by block to delivering roads; sends consist by block to receiving road
BRC INTERCHANGE LOGIC
Modifies processing to account for special I/C conditions at BRC.



HARDWARE CONFIGURATION for data processing is built around a pair of IBM 360/40 computers.

The following examples of moves illustrate how the GMA-ACI system will function. Prior to an interchange move, a header card is prepared designating, for example, GM&O to Penn Central, engine number, caboose number which is placed in input to the GMA central computer. In addition, information on each car is sent to the computer. When the GM&O engine with the interchange cars for the PC at 59th street passes a scanner at 49th street tower, the certified interchange for both roads involved is effected.

For an interchange move over other railroad trackage by the GM&O, say GM&O to Grand Trunk Western, the standard data input procedure is followed. When a GM&O transfer passes a scanner at Corwith South End, the certified interchange is made because the transfer is leaving GM&O trackage.

When a transfer on the Santa Fe with cars destined for the GM&O moves, the ACI network will provide the following information. As the AT&SF cut passes a scanner at Corwith North End, the GM&O will receive a consist listing in sequence from the AT&SF engine, cars in the transfer by initial, number, L or E, type of car, weight, contents, destination city and state, consignee and the road beyond.

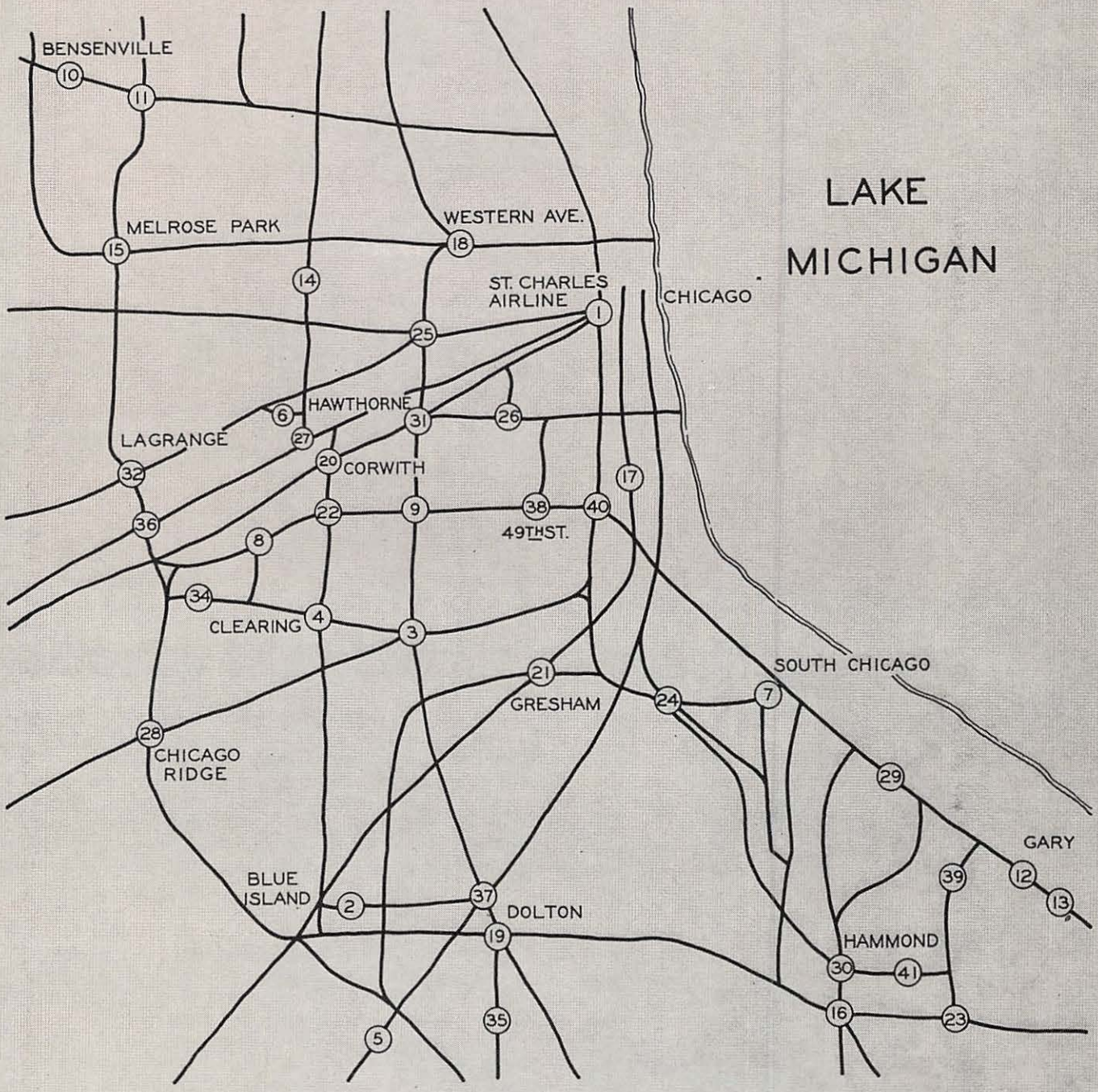
This ACI interchange and information system will verify time of interchange between the GM&O and other railroads based on scanned time plus an established differential designating time between the scanner site and actual point of delivery, where applicable.

Other savings include possible yard switch crews' time from waiting on lists to be prepared before being able to handle cars in an arriving interchange cut. At scanner locations which represent the final terminal delay point, the scanner time of the trains passing is an absolute validated record and can resolve disputes in final terminal delay claims from road crews. Receiving yards will be aware of exact location of expected trains. This information enables these yards to arrange their internal moves in order to have tracks available to receive these trains, and also enables planning of yard moves so as to avoid blocking and delay to yard engines from an inbound train.

Per diem expense can be reduced on most roads as follows: The ACI system will furnish a schedule report by last scanner location on system-owned cars to each railroad. This will promote greater usage of owned equipment vs. foreign equipment by the owner road. Reports furnished daily showing all home route information on interchange cars scanned in the network will expedite the movement of cars by identifying promptly the return routes.

Advance consists will identify immediately to the roads involved in the interchange cars delivered in error or without waybill information. Thus, the time cars would be held in a hold status by the receiving carrier will be reduced. By the reduction of cars in a hold status, per diem savings will be

GMA-ACI INTERCHANGE AND INFORMATION NETWORK WILL HAVE ACI SCANNERS AT 40 STRATEGIC LOCATIONS IN THE CHICAGO TERMINAL AREA



Accurate information interchange on real-time basis is goal.

gained on cars delivered in error or cars delivered without waybills.

Additionally, car utilization and distribution will be improved because the system identifies empty available cars on incoming interchange cuts before they arrive on the railroad.

In general, the ACI interchange and information system is designed to receive advance information on interchange cars from all the member roads, storing this information in a central computer and matching it with the data as it is being received from the scanners which are interfaced with the central computer.

The functions provided in the design for output to the railroads include:

—Generation of an advance consist.

—Arrival messages for use in roads' internal reporting systems.

—O/S reports.

—Outbound train checks.

—Detection and reporting of intermediate set-outs by interchange transfers.

—Detection and reporting of other set-outs (bad orders), exception basis.

—Detection and reporting of set-outs by in and outbound trains at outlying interchange points.

—Detection and follow-up of car data errors and missing data.

—Detection on cars moving without information (no bills) and information on car without car movement (bill without car).

—Provision of certified interchange document on a daily basis.

—Provision to railroads of listing of all of their equipment by the last scanned move in the network.

—Reporting on reverse record moves on all empties received in interchange that have been scanned.

Additionally, the information file of the ACI system will furnish data to permit:

—Developing and monitoring of transfer move standards.

—Monitoring of traffic density statistics for use in determining optimum condition to operate transfers through the Chicago terminal.

—Analysis of type and ownership of empty equipment moving through the terminal.

—Developing scanner performance statistics.

—Analyzing of car movements between railroads.

In addition, the task force report mentioned long range computer applications of the system that could be useful with the fully implemented system. These applications include trailer-container control, performance measurement, simulation techniques, shared time computing and common data interchange. Also consideration is given to working with AAR's TRAIN program, even in the initial phases of the GMA information network. Ultimately, TRAIN could dial the GMA computer and obtain all interchange information for the Chicago Terminal District eliminating the need to contact each member road separately. Similarly, the GMA network could handle member roads' requests to AAR's TRAIN central computer in Washington.

The GMA ACI task force which prepared the report recommending creation of the interchange and information network, was created in July 1969. Chaired by J. M. Goodell, industrial engineer, Burlington Northern, other members include J. L. Williamson, trainmaster, Penn Central; C. D. Lyon, trainmaster, Grand Trunk Western; M. L. Clawson, communications engineer, Rock Island; and the late D. E. Skinner, former trainmaster, Santa Fe.

Analyzed train operations

This task force made a detailed analysis of train operation in the CTD including examinations of dispatchers' train sheets, interlocking and block operators' records, and train schedules. Also, on-the-spot inspections were made of the 40 ACI scanner sites. The task force was created following a one-year study by a 12-member GMA-ACI committee, which determined general guidelines for the more detailed feasibility study.

"The task force report comes at a time when ACI should be removed from the talking stage and put to work assisting the railroads in improving their service, car supply and record keeping functions," says L. A. Brophy, staff assistant special studies, Elgin Joliet & Eastern, and chairman of the GMA-ACI committee.

"We believe that by establishing a network of railroad shared ACI scanners in the Chicago Terminal District substantial progress can be made in improving operating efficiency. At the same time, a shared use of scanners will enable the railroads to receive full benefits from these scanners at reduced costs," Brophy says.

Between now and the first of November, when GMA member roads are to vote on the task force's recommendation to install an interchange and information network, Brophy, the ACI committee and the task force will be working with individual railroads to help them evaluate the proposed system. Also, requests will be directed to ACI manufacturers and other interested firms to submit proposals for hardware, software and ACI equipment for the system. Time limitations permitted the task force to suggest only one method of sharing costs among participating railroads. It was suggested for proration based solely on each railroad's percentage of cars scanned. Other methods of sharing costs for the system will be developed and evaluated.

There is guarded optimism about acceptance of the report and implementation of the interchange and information network because of the feeling that the ACI label deadline will be met—Jan. 1, 1971. Also, since it will take about 20 months to make the GMA ACI system fully operational, the go-ahead signal in November would be appropriate. Additionally, it would take at least three months for member roads to prepare scanner sites and install equipment. Thus the deadline for labeling cars would be behind them when scanners become operational.

Implementation of the proposed ACI network would be on a step-by-step basis, such as installation of scanners in geographical areas. The task force report states that "the proposed communications network lends itself to this approach because there are 10 circuits handling from 7 to 14 scanners, based around various Illinois Bell Telephone Co. exchange offices. Thus, scanner systems could best be installed on a circuit-by-circuit basis.

"Installation of data processing facilities would be carried out over an extended period of time. [Estimated 20 months from start to completion of entire system.] The initial step in such a process, aside from placing orders for hardware, would be procurement of systems/programming personnel, so as to begin systems development as early as possible. During the systems development process, employment of commercial computer services is recommended. Use of such facilities will permit program testing and processing of scanner data during installation of succeeding scanner groups and of computer equipment."

Brophy says that "a lot of the information which we've developed for the Chicago terminal could be invaluable for others. It could be considered standard for all terminals."

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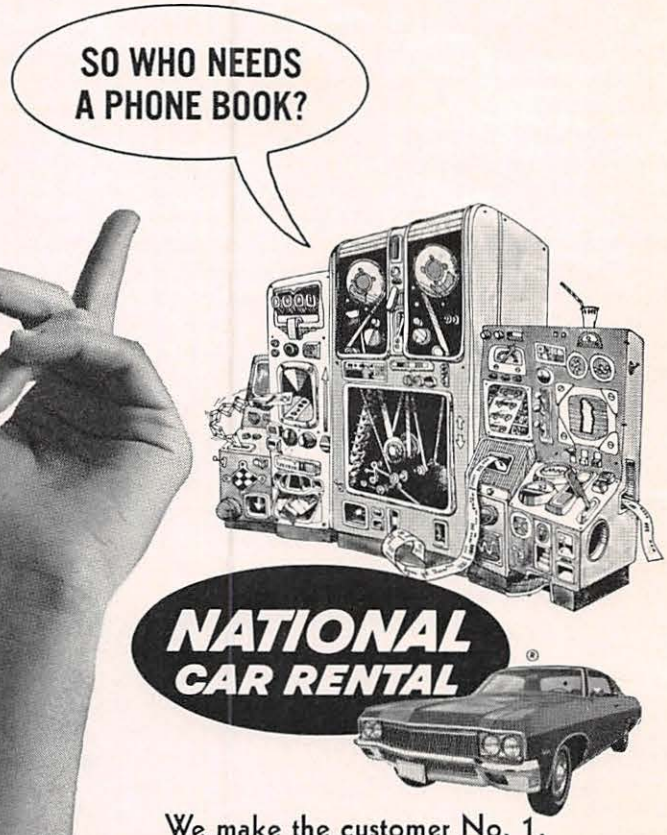

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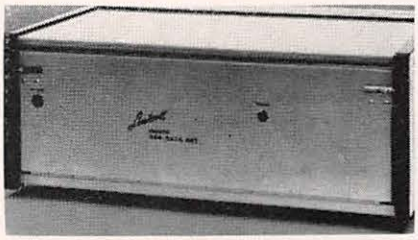
Product News



Data set operates at 4800 bits/sec (101)

A new 4800 bits per second data set, named the 26D, operates at its maximum rate over a standard series 3002 line with C2 conditioning.

The 26D incorporates modified Duobinary Technique which results in relatively uncomplicated circuitry and does away with the need for automatic equalization. This special transmission method actually compresses required bandwidth and concentrates more transmitter power in the useful part of the spectrum by eliminating the DC component and low frequencies from the data signal. The effect is a significant reduction in data errors which provides greater throughput and reduced transmission cost.

Besides the 4800 bps channel, the 26D also allows the simultaneous transmission of a 150 bps secondary channel which can be used for independent low-speed transmission, for control and acknowledgement of transmission on the high-speed channel, or any number of other uses.

The 26D may be arranged for simplex, half-duplex, or fullduplex transmission of data from business machines, computers, instrumentation systems, cryptographic equipment, and other communication of data where high accuracy is a prime requisite. Advanced design of the 26D includes full compatibility with EIA Standard RS-232-B, CCITT recommendation V.24 and MIL-STD-188B. *Lenkurt Electric Co., Inc.*

Switch heaters burn propane gas (102)

A new system of completely automatic gas-burning railroad switch heaters enables one man to remotely turn on switch heaters sometimes 50 to 60 miles away, merely by turning an electrical switch knob. Automatically, gas starts to flow and electrical igniters start the gas flames. A green light on a green control panel tells the operator that the heater is operating.

If the flame should be extinguished for any reason, the green light goes off and a red light goes on. Automatically the electric igniter starts again, reignites the heater. And the green light goes on again. Temperatures are kept within a predetermined temperature range automatically. The switch heaters operate on natural, manufactured or propane gas. If preferred, the heaters can be installed to operate manually or semi-automatically. *White Manufacturing Co.*

Portable unit speeds data tests (103)

A new series of portable test and trouble shooting instruments are capable of rapidly isolating interface problems between telephone modems and data terminals. Called the Dataseeker series, these instruments are designed to facilitate installation, field service, and test of data terminal systems.

Model EIA100 allows electrical access to each of the 25 wires in a standard EIA interface cable. On line tests using the self contained mark, space, and data indicators, speeds fault isolation. Other models contain built in control voltages and data simulation. *Dataprobe, Inc.*

Retarder motor-control is solid-state (104)

Retarder Motor Solid-State Control Panel (D.99.0801) is a new panel that is designed as a direct replacement for electro-mechanical contactor panels. This new module, which uses silicon-controlled rectifiers, has no moving parts and nothing to wear out. It provides faster acting, more precise control than older methods and can be installed very quickly. *General Railway Signal Co.*

Magnetic tape units are compatible (105)

A new family of magnetic tape terminals compatible with its existing equipment will add high-speed on-line capability, up to 2400 words per minute, to existing lowspeed terminals. The magnetic tape data terminal records data on a compact and interchangeable cartridge about the size of a cigarette pack. One cartridge holds up to 150,000 characters of information. Data can be entered from the keyboard of a model 33, model 35, model 37, or Inktronic I/O terminal which use the ASCII code—or on-line from a remote station or computer. A convenient search capability permits an operator to quickly find specific blocks of data stored on the tape.

On-line operation can be as high as 2400 wpm. A single magnetic tape data terminal now combines both send and receive capabilities in one package, which formerly required two. This means easy and economical turn-around traffic—sending and receiving data in a single call at high speed. Individual characters may be corrected by simply rewriting the character. And quick "search" capability provides fast access to locate specific data on the tape. The cartridge provides compact high-volume storage, and can be loaded quickly and easily. The reusability of magnetic tape makes it more economical than paper tape in many applications. *Teletype Corp.*

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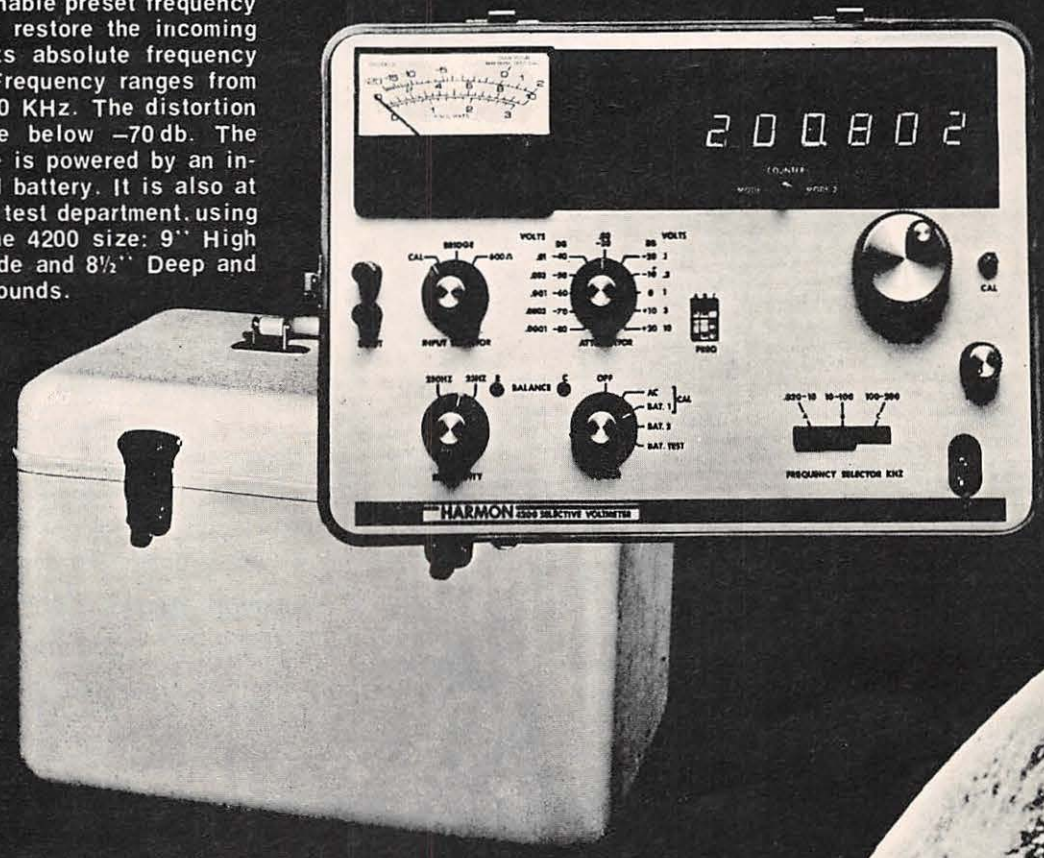

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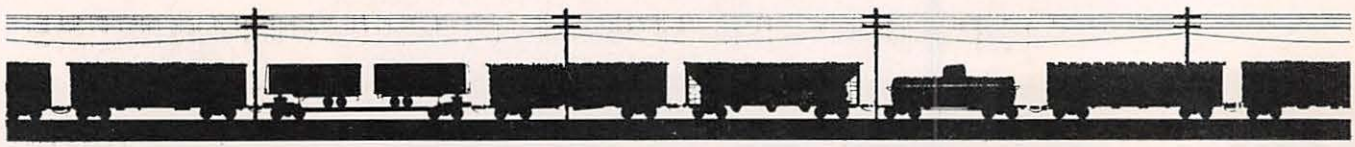

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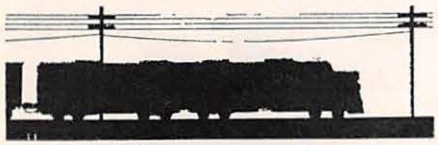

Circle 12 on reader service card

Books

Relay handbook aids application engineers

The revised second edition of the *Engineers' Relay Handbook* has been updated, and expanded to include new sections on reed and mercury-wetted relays, and solid state devices. The handbook covers age of relays. inspection testing, life testing, military specification requirements, and standardized definitions. Particularly helpful features are the discussion of magnet wires, and the description of hybrid combinations of relays and solid state devices.

The aim of the Second Edition remains that of bringing together information that simplifies and clarifies the specifying and obtaining of correct relays. It is important to recognize that the information contained in this handbook is not intended to be of direct aid to the designers and manufacturers of relays. It is aimed, rather, at those individuals responsible for specifying the correct type of relays for a given application.

Engineers' Relay Handbook, Revised Second Edition, National Association of Relay Manufacturers, Hayden Book Co., Inc., New York, 1970, 355 pages, 7⅜" x 10⅛", Price: $13.95.

Electronic circuit books aid design engineers

A revised and expanded third edition of the "Electronic Circuit Design Handbook" is a carefully planned reference source of over 600 different tried and tested circuits. Accurate and clear circuit descriptions are supplemented by over 750 easy-to-follow diagrams, waveforms, and illustrations which contain all component values and other needed data.

Contents include the following circuits: control, regulator, protection, filter and suppression, pulse, comparison, amplifier, oscillatory, indicator and alarm, counting and timing, test and measurement, generator and simulator, converter and inverter, power supply, detection and sensing, display and readout, gating and logic, relay and switching, and miscellaneous such as relay-operated energy restoring mechanism, FM limiter, and point-contact transistor multiplier.

Electronic Circuit Design Handbook, Third Edition, Editors EEE Magazine, TAB Books, Blue Ridge Summit, Pa.. 1970, 384 pages, 8½" x 11", Price: $17.95.

Electronic test handbook aid to technician

A comprehensive source of practical electronic troubleshooting procedures, based on tried-and-tested measurement techniques is now available. Covering a variety of tests on receivers, transmitters, transceivers, antennas (up to and including VHF), and a wide range of accessory equipment, this book clearly shows how to apply factual and crystal-clear information to daily problems.

Contents include general testing procedures; basic test instruments; receiver tests and alignment; transmitter tests and alignment—antenna and transmission line measurements; accessory equipment and component testing; system and interference tests.

Electronic Test and Measurement Handbook, John J. Schultz, TAB Books, Blue Ridge Summit, Pa., 1969, 224 pages, Price: $7.95 hardbound, $4.95 paperbound.

Letters

Our new look!

St. Paul, Minn.

To the Editor:

I think that you should be congratulated on the new look of your magazine. I don't know quite how to express what it has done, or quite how to express my reaction, but after going over the magazine I think it proper to say that it has greater readability. It has been dressed up quite well and I am very proud of it now Bob.

A. L. Essman
Director, Signal Engineering
Burlington Northern

Roanoke, Va.

To the Editor:

Congrats on the new rsc!

Also—"A" on the exciting and important article on electrification! (March issue).

J. M. Francis, Engineer
Signals & Communications
Norfolk & Western

Minneapolis, Minn.

To the Editor:

I am impressed by your new RS&C format. Looks very good.

H. A. Scott
President
Railroad Accessories Corp.

People

CHESAPEAKE & OHIO/BALTIMORE & OHIO: **Joseph Herbert Wallis,** director communications and signal planning at Huntington, W. Va., appointed superintendent of communications, succeeding **Paul Flanagan,** retired. **R. D. Diamond** appointed signal application engineer, Huntington. **O. Nealis, Jr.,** appointed assistant supervisor signals, Peru, Ind. **V. R. Bailey** appointed signal supervisor, Grafton, W. Va. **C. D. Smith** appointed manager computer operations, Baltimore.

DENVER & RIO GRANDE WESTERN: **Edward H. Musgrove,** communications engineer, has retired.

ELGIN, JOLIET & EASTERN: **Arthur O. Edson,** assistant signal supervisor, appointed signal supervisor at Joliet, Ill.

NORFOLK & WESTERN: **J. K. Brown.** general inspector signals and communications, appointed supervisor signals and communications at Cleveland. **J. M. Herr,** assistant supervisor signals and communications, Bellevue, Ohio, appointed supervisor signals and communications, Brewster, Ohio. **J. H. Smith** appointed communications engineer, Cleveland.

SANTA FE: **W. T. Bryan,** assistant to general manager, mechanical department, appointed manager industrial engineering, Chicago.

SOO LINE: **W. J. Olson** appointed manager of revenue accounting and data processing.

Suppliers

COPPERWELD STEEL CO.: **Howard D. Massey** appointed sales engineer at New Orleans to cover states of Alabama, Arkansas, Louisiana, Mississippi, northwestern Florida, and the city of Memphis, Tenn.

DIVERSIFIED INDUSTRIES INC.: **Gerald J. Aul** appointed group vice president, demolition and construction. He will retain the presidency of Diversified Dismantling Corp.

GENERAL ELECTRIC CO.: **R. D. Webster** appointed manager of marketing telecommunication products department, at Lynchburg, Va. **Richard A. Page** appointed manager of editorial services at Lynchburg.

GENERAL RAILWAY SIGNAL CO.: **Vincent P. Kovalcik,** supervisor systems design, appointed market planner-rapid transit. **John J. Morrissey** appointed sales engineer at St. Paul, Minn.. and **Robert A. Sharp** appointed sales engineer at Chicago.

GRAYBAR ELECTRIC CO., INC.: **C. E. Kirkpatrick,** manager Chicago district appointed vice-president and Chicago regional manager. **T. J. LeClair,** Minneapolis district manager, appointed regional marketing manager at Chicago. **W. B. McGhee,** district operating manager at Chicago appointed regional operating manager there. **R. E. Evans** appointed district manager at Memphis; and **C. W. Kraich** appointed district operating manager there. At Indianapolis, **W. W. Crisp** appointed district operating manager and **J. W. Peterson** appointed district manager. In the Chicago district office, **J. L. Hoagland** appointed manager; **J. A. Reagen** appointed operating manager; and **G. W. Freeman** appointed sales manager. The following men have been appointed district managers: **D. E. Clisbee** at Minneapolis, **G. H. Booth** at Houston, **W. T. Brosnan** at New York, **E. A. Grimes** at South San Francisco, succeeding **G. L. Call,** retired; and **G. E. Robie** at Boston, succeeding **J. E. Carroll,** retired. New district sales managers are **M. F. Paulsen** at Kansas City, **L. L. Henry** at Atlanta, **S. L. Dye** at Philadelphia, **J. D. Brown** at Los Angeles and **E. N. Cundiff** at Pittsburgh. **D. R. Wheeler** appointed district operating manager at Cleveland. Appointed as managers are **G. J. Hutt** at Peoria, Ill.; **W. W. Greve** at Fort Wayne, Ind.; **H. J. McGrath** at New Orleans; **L. J. Franklin** at Beaumont, Tex.; **J. A. Harwell** at Corpus Christi, Tex.; **H. A. Bowden** at Birmingham; and **P. J. Pfeiffer** at Dayton, Ohio. New operating managers are **W. A. Hurd** at Santa Barbara, Cal.; **A. T. Duncan** at Chattanooga; **C. W. Doughty,** at Bristol, Tenn.; **W. D. Chaney** at Baton Rouge.

HY-GAIN ELECTRONICS CORP.: **Jason Thomas,** former product sales manager citizen's band radio, E. F. Johnson Co., appointed national sales manager, land and mobile products.

LENKURT ELECTRIC CO., INC.: **Wayne K. Bartley** appointed eastern industrial sales engineer.

LYNCH COMMUNICATION SYSTEMS: **Alan K. Urschel,** former manager of government and industrial sales, Collins Radio Co., appointed vice-president of marketing at San Francisco.

MOTOROLA INC.: **Theodore Saltzberg,** product manager communications division signaling products operations, appointed product manager common carrier products.

NIFE INC.: **Theodore Ulrich,** vice president sales, appointed president.

NORTHEAST ELECTRONICS CORP.: **Joseph N. Petrie,** retired chief transmission engineer, Automatic Electric Co., appointed communications engineering consultant.

OKONITE CO.: The following men have been appointed sales representatives of the Wire & Cable Div.—

(Please turn to page 40)

J. Herbert Wallis
C&O/B&O

Gerald J. Aul
Diversified Ind.

John J. Morrissey
General Ry Signal

Alan K. Urschel
Lynch Comm.

Theodore Ulrich
Nife Inc.

Joseph D. Aldern
Railroad Access.

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PEOPLE

(Continued from page 38)

Mark J. Brill, at Philadelphia; Richard Q. Corley, at Dallas; Jack R. Forsha, at Cleveland, and Gerald F. Wicks at New Orleans.

ONAN: Thomas D. Cochran appointed market specialist–controls, with headquarters in Minneapolis.

RAILROAD ACCESSORIES CORP.: Joseph D. Aldern, sales and service representative at Philadelphia appointed general sales manager at Minneapolis. Ralph Molinari, vice-president sales, appointed vice-president and general manager of the Louisville (Fairdale), Ky., plant, succeeding W. W. Beard, retired. William O. Reinitz, engineer at Minneapolis (Fridley) appointed chief engineer at Fairdale. R. Dan Birt, signal engineer, appointed chief engineer at Fridley. M. L. Litford, circuit engineer, Penn Central, at Indianapolis appointed sales and service representative there.

ROHR CORP.: Deane N. Aboudara, project manager transit systems department, General Electric, appointed senior marketing representative, transportation systems.

SIGNAL & COMMUNICATIONS DIV., WABCO: Herman G. McGrath, former sales manager, Harmon Electronics, Inc., appointed sales engineer at Chicago. F. E. Samrok, supervising engineer, project engineering, appointed senior marketing engineer in charge of automatic car identification system sales.

SYNTONIC TECHNOLOGY, INC.: Leonard R. Eyler, director of operations, appointed vice president-operations.

TRANSITEL COMPUTER SUPPORT SYSTEMS, division of Sangamo Electric Co.: Oren G. Moore, Jr., former director of Sports Systems with Information Concepts, Inc., appointed manager of marketing.

Herman G. McGrath
Sig&Com Div, Wabco

F. E. Samrok
Sig&Com Div, Wabco

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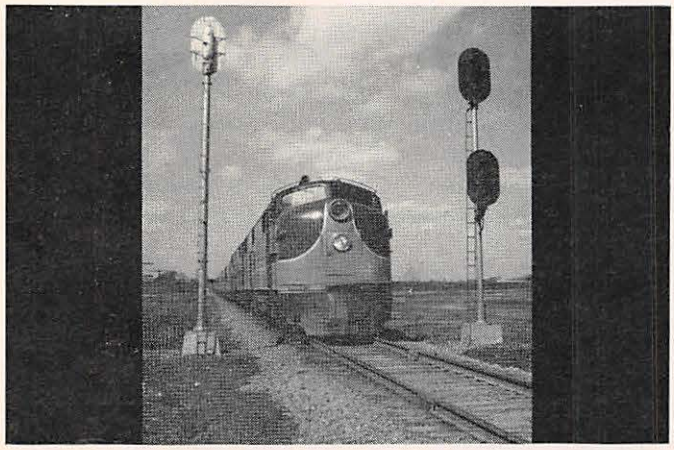

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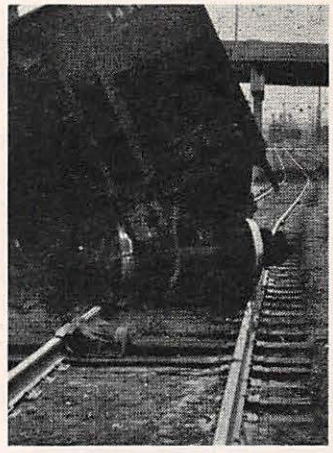

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Editor's Corner

ACI: The time is now!

A Heruclean effort is being made to apply automatic car identification labels to the interchange freight car fleet. Some railroads report upwards of 90% of the cars passing ACI scanners have labels. Indications are that approximately 85% of the fleet is labeled. It appears that the January 1, 1971 deadline for labeling will be met. "With some $17 million spent for labeling, we're not going to quit now. The job will be done on time," says one railroad official.

On the other hand, ACI scanner installations have not kept pace. Tight money, the cloudy economic outlook and the accuracy of ACI systems may be some inhibiting factors to more rapid installation of ACI scanners and systems. Current estimates are that about 100 ACI scanners will be installed or ordered this year. For 1971, another 150 scanners will probably be ordered and installed. And by 1972, the installation rate should reach 250 annually.

To be sure, tight money and the general economy cannot be overlooked. However, the normal time lag of several months from order placement make these two economic factors less important. Accuracy of the ACI system, however, is essential, and is based upon performance of various dependent elements. These are the label, ACI scanner and decoder, communications links, output devices and data processing equipment. That each of these elements may be installed, operated and maintained by several departments of a railroad requires exacting system controls to obtain accurate results. As many as four departments—mechanical, signal, communications and data processing—may be responsible for an ACI system. On most railroads, only three will be responsible—mechanical, communications and data processing. In any case, close cooperation among the departments will be required to make ACI successful.

TOP MANAGEMENT SUPPORT

To put it bluntly, top management is going to have to require that the various departments concerned with ACI make it work. Support from top management must consist of understanding of the situation, and will require approval for expenditures for equipment, planning and implementation.

Computer programming for ACI has received little attention, but this one area is where the tremendous benefits of ACI-generated accurate data can produce the truly big payoff. ACI can provide the accuracy so vital for a management information system data base. ACI-generated data matched with waybill information can also improve efficiency in reporting.

LEADERSHIP BY 22 RAILROADS

Twenty-two Chicago railroads are now evaluating a task force report proposing the installation of an ACI interchange and information network (see page 26). Data from 109 scanners at 40 key sites along 7,689 miles of lines in the Chicago Terminal District would feed into a central computer facility. Information would be processed covering about 95% of the 25,000 interchange cars per day operating in more than 1100 trains. Results would be sent to all participating roads on a real-time basis.

"The task force report comes at a time when ACI should be removed from the talking stage and put to work assisting the railroads in improving their service, car supply and record keeping functions," says L. A. Brophy, staff assistant, special studies, Elgin, Joliet & Eastern, and chairman of the Chicago railroads' General Managers' Association ACI committee.

"We believe that by establishing a network of railroad shared ACI scanners in the Chicago Terminal District substantial progress can be made in improving operating efficiency. At the same time, shared use of scanners will enable the roalroads to receive full benefits from these scanners at reduced costs," Brophy said.

This is positive thinking and it is encouraging to see railroad cooperation on this important matter. The General Managers' Association of Chicago, and especially their ACI task force, chaired by J. M. Goodell, industrial engineer, Burlington Northern, are to be commended for their fine work.

About November first of this year, GMA member roads are expected to decide about installing this ACI system. An affirmative decision will bring a lift to the ACI program as a whole, and to the entire railroad industry. It will confirm that individual railroads can work together for the benefit of all. For the shipper, it will mean the beginning of an active program to reduce delays and improve operations in the nation's largest rail center.

To the GMA member roads, I would strongly urge an affirmative vote to proceed with installation of the ACI interchange and information network.

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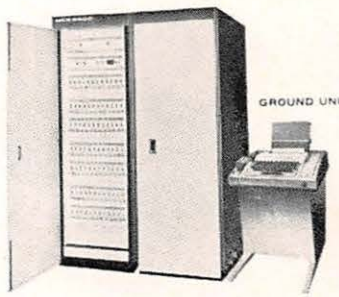

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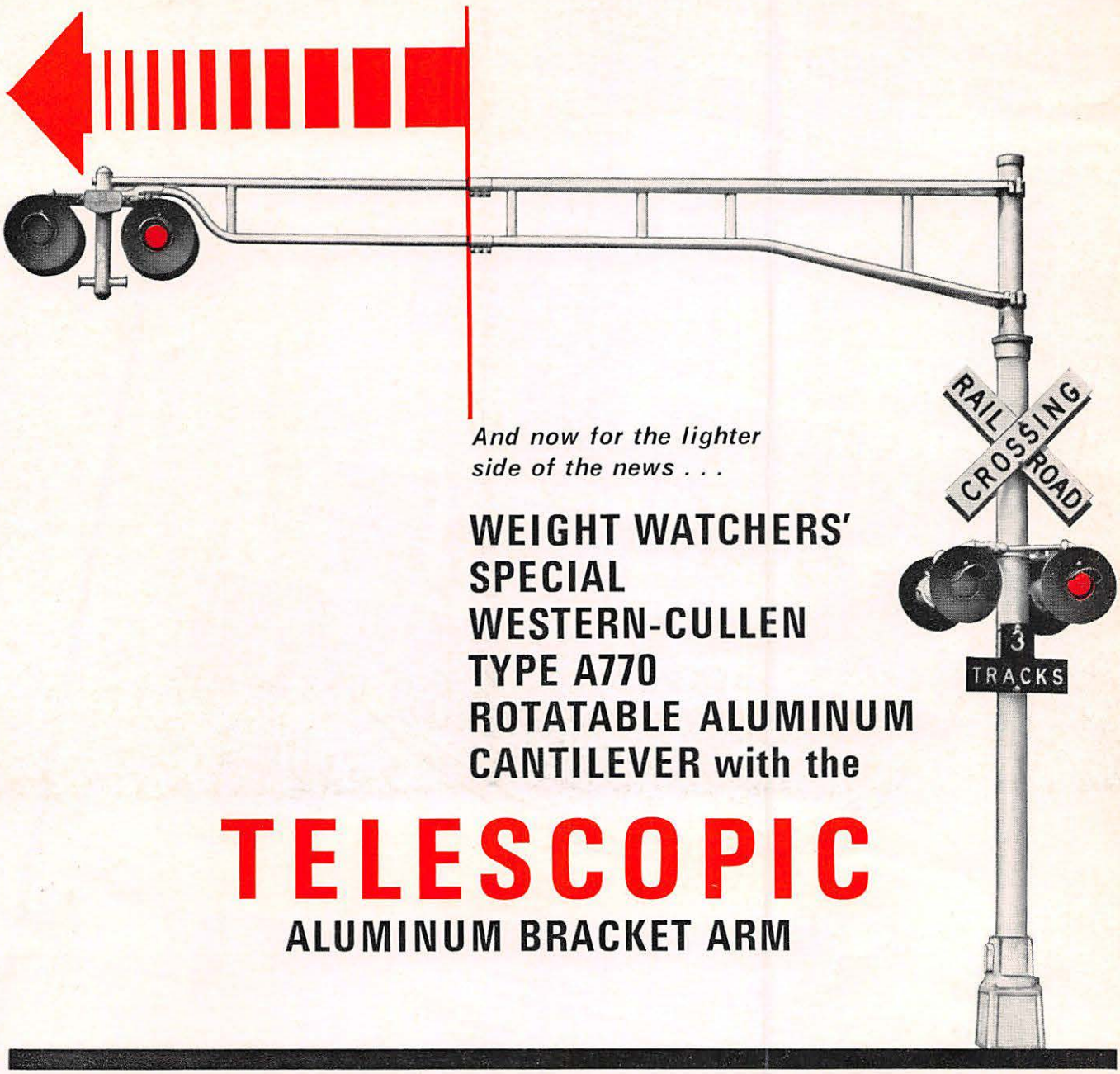

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